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External Jugular Vein Peripheral Intravenous Catheters: An Emergency Nurse's Guide: JEN

ABSTRACT (ENGLISH)

Insertion of a peripheral intravenous catheter into the external jugular vein is regularly performed in emergency departments to treat patients with difficult intravenous access. Although emergency nurses are experienced in inserting peripheral intravenous catheters, there is an inconsistent practice and a lack of education and training regarding the insertion of catheters in the external jugular vein. This manuscript provides a practical guide for emergency nurses to care for patients who require an external jugular peripheral intravenous catheter. Key information found in this manuscript includes indications for external jugular intravenous access, the nurse's role in performing external jugular peripheral intravenous catheters, and clinical considerations when caring for patients with an external jugular peripheral intravenous catheter.

FULL TEXT

Introduction

Insertion of peripheral intravenous (PIV) catheters is one of the most frequently performed nursing skills in the emergency department. Establishing vascular access rapidly and successfully is critical to ensure timely diagnosis and treatment interventions for patients. Emergency nurses are typically highly skilled in PIV catheter insertion; however, patients with difficult IV access can experience delays in care and increased anxiety.[1] The use of the external jugular (EJ) vein can be considered when other veins cannot be accessed.[2] This manuscript will provide emergency nurses with a practical guide on performing EJ PIV insertion and caring for patients who need an EJ PIV based on current evidence-based practice recommendations and current clinical guidelines. In addition, this manuscript will provide information on policy development regarding EJs to promote the safety of patients and emergency nurses in the practice setting.

EJ PIV Catheterization

The EJ vein, located in the anterior and lateral neck, forms from the combination of the posterior auricular and retromandibular vein and runs obliquely across and superficial to the sternocleidomastoid.[3] EJ PIV catheters are peripheral catheters placed in the EJ vein. EJ PIVs are used for emergent access or when other veins cannot be accessed and are only a temporary treatment option.[4] Other less invasive options and technology should be considered before attempting an EJ PIV, such as vein lights or ultrasound guided IV insertion.

When inserting a PIV in the EJ, it is important to use the smallest-gauge catheter that can be used for the prescribed interventions to decrease vessel damage and to ensure adequate blood flow around the catheter, subsequently reducing the risk of phlebitis.[5] Equipment needed to perform the procedure includes gloves and other necessary personal protective equipment (eg, gown, goggles), antiseptic solution such as chlorhexidine or alcohol, an IV catheter (16-20 gauge), saline lock or luer lock adapter, saline solution (saline flush), and a transparent dressing (Table).[5]

Before attempting an EJ PIV, it is important to ensure that there is a provider prescription or order. After verification of a provider prescription or order and gathering necessary equipment, patients should be positioned in a lying position, preferably in the Trendelenburg position (if it can be tolerated by the patient) (Figure 1). It is important to thoroughly assess a patient's understanding of the procedure and their anxiety level. Repositioning a patient in the Trendelenburg position can create respiratory complications and anxiety if the patient has any type of

cardiorespiratory compromise. It is important to ensure that the patient can emotionally and physically tolerate the procedure and is able to remain still to prevent dangerous complications that could occur if the surrounding tissue is punctured with the IV catheter needle.

To complete the procedure, the patient's head should be slightly tilted to the opposite side, and light pressure can be applied above the clavicle to help visualize the EJ vein (Figures 2-4).[5] The skin should be thoroughly cleaned with antiseptic solution and allowed to dry. The vein should be stabilized using the nondominant hand to minimize vein movement during the procedure (Figure 5). The PIV should be inserted with the bevel up at a superficial angle (≤ 30°).[3,5] Upon entry into the vein, blood should appear in the chamber, and the catheter should be advanced an additional 2 to 3 mm into the vein. There may not be a considerable flash of blood into the catheter, or it may occur more slowly than in other peripheral veins because of the lower pressure in the EJ vein.[3] The IV catheter needle should then be removed while advancing the IV catheter into the vein. The preflushed saline lock or luer lock should then be attached to the catheter and secured with a transparent dressing (Figure 6).[5] If venous catheterization is unsuccessful, the catheter should be removed, and direct pressure should be applied to the area for 5 minutes.[5]

Emergency Nurses' Role in EJ Vein Access

Historically, there has been a great deal of uncertainty and debate regarding the PIV insertion into the EJ vein by emergency nurses. The position of the Infusion Nurses Society (INS) is that a qualified registered nurse may insert, maintain, and remove external jugular PIV catheters.[4] The INS supports the use of an EJ PIV in acute care settings and in emergency situations when other veins cannot be accessed. However, an alternative vascular access site should be identified as soon as possible.[2]

It is important to note that an emergency nurse should seek out clarification from the Board of Nursing in the state in which they practice before performing EJ PIV insertion. The position of the Board of Nursing varies, with many states following the INS recommendations and allowing qualified registered nurses to insert EJ PIVs.[6] However, some states only allow EJ PIV insertion in the event of a "life threatening situation."[7] Other states require that the facility in which the nurse is employed have clearly outlined policies and procedures regarding the insertion of an EJ PIV with a required educational component.[8] As an emergency nurse, it is important to stay up to date on one's respective State Board of Nursing's position on EJ PIV insertion by registered nurses.

Registered nurses should only perform EJ PIVs if they have been trained to perform the procedure. Emergency nurses should advocate for their respective employer to provide training and policies to support the insertion of EJ PIVs within their facility. Formal policies can establish guidelines and the standard of care expected of the nurse by the employer when performing EJ PIVs to reduce practice variability (Figure 7).

Clinical Considerations

EJ PIVs are commonly inserted in patients with problematic peripheral access. Conditions that can lead to difficult vascular access include obesity, chronic illness, hypovolemia, IV drug abuse, and vasculopathy.[9] The EJ is not the ideal choice for venous cannulation and should only be used as a temporary option.[3] Contraindications for EJ PIV insertion include patients with an inability to lie flat or remain still, trauma or burns to the neck area, infections at or near the intended insertion site, cervical injuries, and nonvisible or nonpalpable EJ vein.[10] EJ PIV insertion should not be attempted on patients who are noncompliant or unable to follow instructions because of the risk of IV catheter discontinuation or dislodgement by the patient.

Complications of EJ PIVs include hematomas, infection, infiltration, and air embolisms. An air embolism is a severe complication that can result in sudden cardiac arrest and death and has been reported with central venous cannulation.[11] Arterial cannulation may also accidentally occur with IV catheter insertion and can lead to tissue necrosis and ischemia.[12] If an artery is cannulated unintentionally, the catheter should immediately be removed, and pressure should be applied to avoid hemorrhage or other potential complications.[12] The EJ PIV sites should be closely monitored for signs of complications, which include erythema, warmth, cool sensation, or increased pain at the site. The emergency nurse should always use luer-lock connectors to reduce the chance of IV catheter disconnection from the IV line, which can lead to bleeding or increased risk of air embolism.[11] IV infusion pumps should always be used when infusing medication into an EJ PIV to promote patient safety. EJ PIVs are

contraindicated with high pressure injection systems typically used in radiology, owing to the increased risk of extravasation.[13] Vesicant solutions such as vasopressors should not be infused through EJ PIVs because of the risk of tissue damage and necrosis.[5] Nursing documentation should include the insertion site, the PIV catheter gauge, the number of insertion attempts, and how the patient tolerated the procedure.

Conclusion

The insertion of EJ PIVs is a valuable therapeutic technique for emergency nurses to perform on patients in the emergency department. Emergency nurses should be trained according to facility policy and procedure to perform EJ PIVs on patients within their scope of practice on the basis of the rules and regulations of their respective State Board of Nursing. EJ PIVs allow for rapid IV access and treatment to improve patient outcomes; therefore, competency with this skill benefits patients, nurses, and health care organizations.

Author Disclosures

Conflicts of interest: none to report.

Indications	•Patients with difficult vascular access•IV administration of fluid, medications, or blood products•Emergencies in which no peripheral site is available or easily accessible
Contraindications	•Patients with infections, burns, or injury near the neck or the external jugular vein site•Patients who are unable to lie flat or remain still•Patients who are noncompliant or unable to follow directions•Patients with external jugular vein thrombosis•Patients with bleeding disorders or abnormal clotting values•Patients requiring IV administration of vesicant solutions
Supplies	•Personal protective equipment (gloves, gown, and goggles)•Antiseptic solution (chlorohexidine is preferred)•IV catheter (16-20 gauge)•Saline lock or luer lock adapter•Saline solution (saline flush)•Transparent dressing and tape
Nursing considerations	•Ensure that there is a provider prescription or order•Position patient in a lying position, preferably the Trendelenburg position with head tilted slightly•Ensure that the patient can emotionally and physically tolerate the procedure•Reduce risk of infection by maintaining sterility of catheter and cleaning site•Ensure adequate training and competency when performing procedure, check the position of the State Board of Nursing in the state in which the nurse is practicing

IV insertion procedure	•Position the patient’s head to face the opposite direction of the site•Apply light pressure above the clavicle to help visualize the external jugular vein•Thoroughly clean the insertion site with antiseptic solution and allow it to dry•Stabilize the vein using the nondominant hand to minimize vein movement during the procedure•Insert the intravenous catheter with the bevel up at a superficial angle (<30°)•Upon entry into the vein, look for blood to appear in the chamber, and then advance the catheter an additional 2-3 mm into the vein•Advance the IV catheter while simultaneously removing the needle•Attach the preflushed saline lock or luer lock to the catheter and secure with a transparent dressing and tape•If venous catheterization is unsuccessful, the catheter should be removed, and direct pressure should be applied to the area for 5 minutes
Adverse events and interventions	•Air embolismoReduce the risk by using a luer-lock connector and minimizing disconnection of lines from the intravenous catheter and ensuring that saline locks or luer locks are preflushed during IV insertionoAssessment findings related to this condition include signs and symptoms of an air embolism including anxiety, tachycardia, difficulty breathing, and decreased oxygen saturationoTreatment includes life-saving interventions to reduce the risk of cardiac arrest and death associated with emboli•BleedingoReduce the risk by avoiding EJ insertion in patients with bleeding disorders or abnormal clotting valuesoAssessment findings related to this condition include bleeding at the catheter insertion siteoTreatment includes holding pressure to the insertion site for 5 minutes and frequent reassessment to ensure that bleeding has stopped•Extravasation and infiltrationoReduce the risk by ensuring the catheter is fully in the vein and assessing frequently for dislodgmentoAssessment findings related to this condition include warmth, pallor, swelling, pain or burning, and difficulty infusing fluids through the IV catheteroTreatment includes removing the catheter and assessing the site frequently for tissue damage•Arterial cannulationoReduce the risk by using appropriate landmarks to avoid unintended arterial cannulationoAssessment findings related to this condition include backflow of pulsatile bright-red blood, pain on injection, and blanching distal to injection siteoTreatment includes immediately removing the catheter and holding firm pressure to the IV insertion site
Patient teaching	•Educate the patient on the importance of remaining still during the procedure•Patient should immediately report any bleeding or pain at the site, as this can indicate complications
Medication and IV fluid considerations	•No vesicant solutions should be administered through the EJ PIV (including medications with a pH <5, pH >9, or osmolarity >600 mOsm/L, including sclerosing solutions, some chemotherapeutic agents, and vasopressors)•All medications and fluids should be administered using a pump to minimize the risk of complications•Radiology power injectors should not be used with an EJ PIV

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Professional Self-Concept, Job Stress, and Triage Competency Among Emergency Nurses: Secondary Data Analysis of a Cross-Sectional Survey: JEN

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ABSTRACT (ENGLISH)

Introduction

This study aimed to evaluate the indirect relationship of job stress with triage competency through professional self-concept among emergency nurses in Korea.

Methods

A secondary data analysis of survey data from 132 questionnaires was used. A convenience sample of emergency nurses working in regional or local emergency centers in 2 Korean cities was recruited for the survey. Study variables were analyzed using descriptive statistics, correlation, and a model tested using the Hayes PROCESS macro (Model 4) mediation model.

Results

Job stress alone was not associated directly with triage competency (β = 0.01, *P* = .74). An indirect pathway was observed between job stress and triage competency through professional self-concept (*F* = 5.85, *P* < .001, *R2* = 0.33). In the tested model, job stress was associated with professional self-concept (β = −0.05, *P* <.05) and professional self-concept was associated with triage competency (β = 0.79, *P* ≤ .001).

Conclusion

Professional self-concept may be an important determinant of triage competency among emergency nurses. To increase triage competency among emergency nurses, individual nurse and management efforts are recommended to foster professional self-concept and reduce emergency nurse job stress.

FULL TEXT

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The Great Resignation, Newly Licensed Nurse Transition Shock, and Emergency Nursing: JEN

ABSTRACT (ENGLISH)

ECRI boldly called out the impact of precipitating workplace factors stemming from electronic health records (EHRs), time pressures, heavy patient workload, patient complexity, rapid change, and limited resources on a workforce largely comprising high achievers.4 They emphasized the importance of listening to clinician concerns, leveraging change at the system level to address the underlying causes such as improper resource allocation, and ending the treatment of employees as “cogs in a wheel.” Workplace elements solidly coupled with emergency nurse burnout and turnover include difficult work schedules and shift work, inadequate support by leadership, and escalating workplace violence toward staff.7,8 Layer on frustrations caused by a lack of essential supplies and equipment, barriers to patient flow, inadequate staffing relative to demand, and ever-increasing regulatory burdens. COVID-19 added the threat of infectious disease contagion, potentially without adequate or appropriate personal protective equipment, and worsened the nurse-specific trauma of caring for scores of critically ill and dying patients in a time of insufficient and even rationed resources.9-11 The system dysfunction that created the conditions for nursing burnout and turnover before the pandemic was magnified by COVID-19–related surges and stressors.12,13 While temporary and travel nurse staffing agencies have long filled a need for short-term nursing labor demands, the value and demand for nursing skills multiplied during the pandemic.14,15 For institutions that had undervalued long-term nurse employees and nurse retention, the pay gaps between loyal nurse employees and temporary or travel nurses created further backlash from employees, contributed to additional turnover, and saw institutional attrition spiral. The prolonged pandemic disaster context exposed emergency nurses to additional risk factors for burnout, grief injury, fatigue injury, moral injury, and traumatic injury.11,13,21 In the resulting gaps in stable existing workforce supports, we also discuss how quintessentially timely and important regional and specialty-wide resources and infrastructure will be for new nurse transition support.21,22Transition Stages and Transition Shock Models The first year of professional nursing is profoundly transformative.19 Assuming supported and evolutionary developmental knowledge and skill pathways were offered during nursing education, one might expect that new nurses would be able to anticipate a relatively stable postgraduate period rather than the steep, dynamic, and tumultuous learning curve they actually find.

FULL TEXT

The Great Resignation

There is a phenomenon occurring across all employment settings in the United States that is aptly termed **The Great Resignation**. Anthony Klotz, an organizational psychologist and business professor, named this trend in 2019, the year before the COVID-19 pandemic, when annual worker turnover reached an all-time high.[1] Although the rate plateaued in 2020 with the advent of the pandemic, turnover again set new record levels both in 2021 and 2022, leading to extensive nationwide job vacancies.[1] Nursing turnover is no exception in The Great Resignation trend. The origins of the present nursing turnover problem predate COVID-19 and center on factors broadly attributed to nursing burnout.[2,3] Solutions that focus solely on building nursing resilience and exclude workplace-related causes

are particularly short-sighted. This approach targets the nurse without the necessary organizational due diligence to identify correctable issues in the practice environment that contribute to burnout. The end result risks creating a false mindset that the nurse and not the system must be fixed.

The Joint Commission published a prepandemic safety brief in July of 2019 on combating nursing burnout.[2] The Joint Commission warned that burnout could affect cost, patient satisfaction, and clinical outcomes. This report drew upon results and recommendations from a wide variety of sources, noting that emergency nurses are at higher risk for burnout.[2,3] In addition, in 2019, ECRI (formerly called the Emergency Care Research Institute and now by the initials ECRI) identified "burnout and its impact on patient safety" as number 3 in their list of top 10 patient safety concerns.[4] They emphasized the risks to patient safety in cases of health care professional burnout, as well as the association of depression and suicidal ideation in physicians, nurses, and allied health professionals experiencing burnout. ECRI boldly called out the impact of precipitating workplace factors stemming from electronic health records (EHRs), time pressures, heavy patient workload, patient complexity, rapid change, and limited resources on a workforce largely comprising high achievers.[4] They emphasized the importance of listening to clinician concerns, leveraging change at the system level to address the underlying causes such as improper resource allocation, and ending the treatment of employees as "cogs in a wheel."[4]

In 2020, Dall'Ora et al[5] examined 91 quantitative studies that looked at relationships between nursing burnout and work-related factors. Not surprisingly, their findings revealed that high workload, low control, inadequate staffing, and long shift length are notably associated with burnout. These researchers also identified a negative impact on nurses' general health and more sickness-related absences; nursing work performance worsened with resultant declines in patient care quality, safety, and experience, as well as increased medication errors, adverse events, patient falls, and greater intentions to leave.[5] Given these findings, it is ironic that health care institutions commonly employ a do-more-with-less business mantra as an overall financial strategy. This paradigm typically means that nursing leaders are expected to ratchet down staffing levels to the bare minimum, despite having no ready options to provide backup for sick time, leaves of absence, and resignations, particularly in specialties such as the emergency department. At the same time, expectations remain high for nurses working short staffed and with a resulting heavier workload to achieve the finest patient satisfaction, patient care quality, and publicly reported metrics.

The stressors inherent in being a frontline emergency nurse, even during nonpandemic conditions, are significant. As the 24-hour, 7-day-a-week entry point into hospitals and health systems for all-comers, emergency nurses regularly experience all of the factors identified by ECRI as contributing to burnout, including time pressures, heavy patient workload, patient complexity, rapid change, and limited resources.[4] A poorly designed or implemented EHR that drives dysfunctional workflow rather than workflow driving EHR design also contributes to burnout.[6]

Fast forward to 2022. A systematic review of academic studies that focused on emergency nurse burnout and resilience by Phillips et al[7] identified steep burnout rates in emergency nurses; burnout was strongly associated with higher turnover in emergency nurses than in other health care specialties. Workplace elements solidly coupled with emergency nurse burnout and turnover include difficult work schedules and shift work, inadequate support by leadership, and escalating workplace violence toward staff.[7,8] Layer on frustrations caused by a lack of essential supplies and equipment, barriers to patient flow, inadequate staffing relative to demand, and ever-increasing regulatory burdens. COVID-19 added the threat of infectious disease contagion, potentially without adequate or appropriate personal protective equipment, and worsened the nurse-specific trauma of caring for scores of critically ill and dying patients in a time of insufficient and even rationed resources.[9-11]

The system dysfunction that created the conditions for nursing burnout and turnover before the pandemic was magnified by COVID-19–related surges and stressors.[12,13] While temporary and travel nurse staffing agencies have long filled a need for short-term nursing labor demands, the value and demand for nursing skills multiplied during the pandemic.[14,15] For institutions that had undervalued long-term nurse employees and nurse retention, the pay gaps between loyal nurse employees and temporary or travel nurses created further backlash from employees, contributed to additional turnover, and saw institutional attrition spiral. Even before the pandemic, the largest portion of the new emergency nursing workforce was composed of newly licensed nurses.[16] It is logical to anticipate that

newly licensed nurses will become an ever-increasing proportion of the immediate postpandemic workforce. Existing workforce turnover and mobility place new nurses entering the workforce in unprecedented unit instability and experiencing significant gaps in support.

Newly Licensed Emergency Nurses

Retaining seasoned nurses is essential to high-quality patient care, and we will focus editorial content on the occupational health of the current emergency nursing workforce in future issues. As late spring and summer are hallmark seasons for nursing school graduation and subsequent newly licensed nurse hiring, we focus this May issue editorial on entry to practice for the newest members of our specialty. The unpredictable, complex, and intense nature of emergency nursing presents special challenges to nurses who enter the specialty directly after graduation.[17] The Transition Stages (Figure 1) and Transition Shock (Figure 2) models[18-20] provide a holistic framework that can be used to increase our collective understanding of new nurse transition to practice. The insight offered by these constructs promises to illuminate areas where interventions are needed to support the newest members of our emergency nursing workforce at this especially vulnerable time. In the past, transition support for newly licensed nurses and nurses new to the specialty largely fell to unit-based preceptors, mentors, and educators. The prolonged pandemic disaster context exposed emergency nurses to additional risk factors for burnout, grief injury, fatigue injury, moral injury, and traumatic injury.[11,13,21] In the resulting gaps in stable existing workforce supports, we also discuss how quintessentially timely and important regional and specialty-wide resources and infrastructure will be for new nurse transition support.[21,22]

Transition Stages and Transition Shock Models

The first year of professional nursing is profoundly transformative.[19] Assuming supported and evolutionary developmental knowledge and skill pathways were offered during nursing education, one might expect that new nurses would be able to anticipate a relatively stable postgraduate period rather than the steep, dynamic, and tumultuous learning curve they actually find.

The Transition Stages Model is organized by months of nursing practice postgraduation; the transition experience depicted therein occurs within 3 stages over the initial 12 months of practice. The model conceptualizes the stages as (1) doing, (2) being, and (3) knowing.[19] Rather than just focusing on the professional knowledge and skill that a nurse must acquire to function in the job, the model holistically integrates the impact and influence of cognitive, emotional, sociodevelopmental, physical, and personally relational factors that span the new nurse's work and personal life. Information about how the model was developed and the characteristics of each stage is published in detail elsewhere.[18-20] The model is briefly summarized here.

The first stage of transition has been coined the doing stage.[18,19] New graduate nurses enter the work environment with varying levels of familiarity with practice expectations and the workplace culture, often experiencing it as unstable and unpredictable. Facilitating realistic professional expectations should focus on assisting the graduates in acquiring a routine for the shift while providing preceptorship and mentorship. Meanwhile, backup and mutual support are required for situations requiring skill development and evolving clinical judgment. A narrow focus on task completion and time management should be expected and augmented with preceptor and team nursing support. While investing substantial emotional and cognitive energy into appearing competent to gain coworker acceptance and approval, the new nurse often arrives to their new practice environment with minimal tacit knowledge. The new nurse may face patient complexity, change of condition, and unfamiliar patient presentations with little or no experiential knowledge to guide them.[23] In an environment fraught with immense pressures to rapidly become an independent clinician, quality and safety might be compromised if the new nurse hides their need for dependence on their experienced colleagues. The new emergency nurse may struggle to balance their important learning and status-seeking needs with feeling burdensome to the clinical team.[24] This developmental hurdle can, during the initial practice months, translate into vulnerable levels of care competency if the graduate does not feel safe exposing their inadequacies.

Transition shock (Figure 2) is the initial experience of leaving the familiar student experience and entering the unpredictable and unfamiliar context of the professional practice realm. This period can last days or weeks and is

commonly accompanied by feelings of profound doubt, loss, confusion, and disorientation.[18] Figure 2 outlines key areas of imbalance that may lead to stress and transition shock in the nurses' personal and professional roles, responsibilities, relationships, and knowledge. Many of these issues are amenable to assessment and intervention, such as clarifying realistic and developmentally targeted performance expectations and clinical growth ladders, offering structured and unstructured peer support networks, and matching graduates with role models who exemplify success on key professional issues such as navigating a work-life balance, striving for and advancing practice standards, managing their time amid competing priorities, and working collaboratively with inter- and intradisciplinary colleagues. Transition shock is as personal as it is professional; graduates will oftentimes be struggling to find their independence as young adults, including managing their own finances and initiating new or more complex relationships (ie, marriage, cohabitation, or parental responsibility). Likewise, we suggest that unit and institutional leaders and professional organization support networks can offer formative needs assessments based on the various stressors depicted in the Transition Shock model. These assessments can be used to inform priority areas where holistic support can be offered to ease the shock and transition for the newest members of the profession (see examples in Table).

The second stage, coined by Duchscher[19] as the being stage, finds the new nurse experiencing frustration and discontent with their own professional performance gaps. This relative expression of inadequacy can progressively turn outward as criticisms of the unit practice standards or further to health care system deficiencies and failures. The nurse's thinking can shift from a sense that they as an individual only need to acquire more knowledge and skill to address practice realities on to accepting the realities of professional nursing as overall quite different from what they had envisioned when they chose nursing. This can lead to the nurse questioning whether the nursing discipline was the right career choice for them. This is one of the most at-risk stages of new nurse transition for both job turnover and for leaving the profession. This crisis of confidence can cumulate into a transition crisis as the new nurse moves from the being to the knowing phase approximately 6 to 8 months after orientation.[18,25] Monitoring the new nurse during this stage for signs of disillusionment or expressions of disappointment in the profession is paramount to guiding them to a new level of acceptance of practice realities in health care.

The final stage in the Transition to Practice model is identified as knowing. In this stage, the nurse begins to fully integrate work-life balance, recovers from the steep initial learning curve, and commonly finds a sense of personal normalcy and professional identity.[19] After 12 to 18 months of practice, the nurse may be fully ready to engage by leading unit improvement projects, precept others, and contribute beyond the individual clinical patient assignment. Although the models discussed here were developed on the basis of data from new graduate nurse transition, there may be broader applications to other emergency nurses as well.

Experienced nurses working in novel contexts can also experience transition shock, but it is largely muted and abbreviated from that of a newly graduated nurse. The work demands of the pandemic with staffing shortages and challenging workloads have resulted in a daily clinical shift that is nearly unrecognizable to many when compared with prepandemic workflows. This means that even the most experienced nurse may feel a profound loss of professional mastery and identity. The Stages of Transition and Transition Shock Model can also be tested for their applicability to any emergency nursing career transition. These career transitions may range from transferring to a new unit, position, or specialty to a profoundly altered work situation in one's long-term employing unit. The 6-month "WHAT AM I DOING?" transition crisis and the imposter syndrome that Duchscher[19] elegantly describes may have much broader applications to consider in career transitions and assuming new leadership responsibilities along the entire professional continuum.[25-27]

Supports and Interventions

Given the urgent and timely need to recruit and retain high-quality emergency nurses, best-practice pathways for new graduate nurses entering this specialty must be developed, refined, and shared. The availability of mentors, preceptors, and coworkers experienced in the specialty and the employing unit are likely to be limited, given pandemic turnover and stressors. It is not unusual to hear seasoned nurses share stories of situations in which they had to succeed by their own individual efforts or fail the patient and professional challenge entirely. There is a

common theme in the Rubicon of sink or swim as it related to career moments in our professional socialization as emergency nurses. Survivor bias can enter these stories where we are profoundly missing the voices of those who had a crisis moment without support and left emergency nursing after experiencing the resulting negative patient and professional outcomes. The Stages of Transition theory and Transition Shock model presented here frame the stressors and stress reactions of adapting and assimilating to professional nursing as normal, expected, and even embraced developmental phases.[18,19] These frameworks can help remove unnecessary blame and shame from the nurse experiencing these crises and shock reactions from our collective norms. The models can also aid preceptors, managers, educators, and coworkers to set realistic and transition-appropriate professional expectations, rather than applying the traditional and largely dysfunctional sink or swim mentality. The models can also be very useful in anticipating and addressing relatively predictable stress reactions to support the newly licensed nurse or any transitioning nurse practicing in the emergency department setting. These frameworks also serve the specialty with key reminders to stay connected and updated on our newest specialty members' key benchmarks throughout a healthy transition such that we can facilitate a satisfying and lengthy career in emergency nursing.

Shanafelt et al[28] summarized the pandemic-related needs that frontline clinicians have expressed they need from their organizations as Hear Me, Protect Me, Prepare Me, Support Me, and Care for Me. These themes are derived from clinicians across the career span and not just new nurses as we discussed here. How inspiring to envision that we can collectively and individually structure support for one another through our organizations in this way and to know that we can be each other’s light despite the surrounding darkness of the pandemic. It is simply no longer reasonable, or honestly feasible from a human resource capacity perspective, to expect a seasoned clinical unit preceptor to bear a disproportionate amount of the burden for successfully onboarding new nurses, especially when facing their own risk of stress injury and burnout.[13,16,29]

In addition to raising awareness and understanding about transition crises and its triggers in less-than-ideal work environments, we recommend that emergency clinicians at all levels of practice engage in dialogue and activities to build a shared understanding of the stages of transitions, clarify the impacts in your own workplace or professional social network, and craft interventions to support healthy transitions.[30,31] External resources to support the new emergency nurses’ knowledge acquisition include ENA University pathway for those new to the specialty, the ENA Nurse Residency Program, Board Certification for Emergency Nursing Learn,[32] Nursing the Future, and other academic and professional organizational learning supports in your region.[31,33] Certification and certification preparation are open to newly licensed nurses, which offer pinnacle professional identity support and validation.[34] The ENA offers Emerging Professionals activities for leadership and social support tailored for those new to the specialty. We also encourage local chapter and council activities to welcome and mentor role, responsibility, relationships, and knowledge holistic learning needs of our newest members of the clinical specialty. Along with these onboarding efforts, retention of the new emergency nurses as well as the experienced nurses is critical. To reverse the flight of talent, we believe that health care leaders must actively address the organizational sources of stress and burnout and transform their operations to create gratifying work environments.[35] Key to this work is defining new evidence-based budget strategies that provide the human and physical resources necessary for safe practice and high-quality care delivery as opposed to relying on current industry benchmarks that do not adequately represent the clinical reality for frontline emergency nurses.[35]

Given that there may be a dearth of available mentors, preceptors, and clinical educators owing to pandemic-era workforce turnover and vacancies, the time is ripe for creatively exploring algorithmic clinical guides for novices[23] and virtual (including virtual reality and online simulation)[36] and structured external supports for newly licensed nurse training and support. Preparing and retaining the next generation of emergency nurses in this moment in time is filled with challenges and barriers, but the innovation, perseverance, and culture of rising above the crisis and spirit of emergency nurses are poised to overcome to an even more promising future. We welcome rigorous program development, evaluation, and intervention testing manuscripts to address emergency nurse orientation and newly licensed transitions to the emergency department in the *Journal of Emergency Nursing*.

Author Disclosures

Dr. Castner is President and Principal of Castner Incorporated, a New York State woman owned business enterprise.

Transition shock stressor	Example support activity
Life roles: partner-spouse	Off unit mentor or role model who can discuss and help develop strategies to mitigate new home relationship strain created with first time working night and/or weekend shifts.
Skills and tasks	Nurse residency program, formal professional development onboarding, professional association courses, virtual or augmented reality skills practice, extra skills lab practice at home education institution.
Financial management	ENA Council meeting with financial planning speakers or vendors with content relevant to new nurse household budgeting, student loan repayment, and common early adulthood or early career financial goals.
Intergenerational dynamics	Off unit education lab or virtual reality simulation with facilitated role play activities to explore and develop better response, coping, or understanding of frustrating or puzzling intergenerational dynamics.
Life changes	Inclusive celebratory and acknowledgment events, rituals, and routines to recognize marriage, births, new homeownership, or other major life event.
Role stress/strain	Realistic expectations, structured and unambiguous orientation and onboarding pathway. Information for organization's EAP and external therapists trusted by nurse coworkers if requested by new nurse.

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Clinician Wire Puncture Injury to the Hand from Chest Compressions on a Patient with a Median

Sternotomy: A Case Report: JEN

ABSTRACT (ENGLISH)

Standard precautions, including protections from blood and body fluid exposure, are designed to protect health care providers from infections. Sharps safety practices rarely include the potential for the unconscious patient's own body to be a potential source of clinician percutaneous injury from sharp objects outside of the perioperative setting. This case report reviews a percutaneous injury to the hand of a physician who was performing chest compressions on a patient with an out-of-hospital cardiac arrest. The 76-year-old patient in cardiac arrest had undergone a medial sternotomy surgery 15 years before the arrest. The sternal wire rotated owing to the initial chest compressions, breaking the clinician's nitrile glove and producing an open wound on the thenar region of the clinician's right hand. Application of a 10 × 10 12-ply gauze pack on the chest of the patient in cardiac arrest allowed the resuscitation team to continue with the compressions with no further wounds from the wire. This case report is a novel contribution to the published literature and advances standard precautions considerations in patients with out-of-hospital cardiac arrest, with the sternotomy wire from previous surgery as a source of percutaneous clinician injury during chest compression.

FULL TEXT

Introduction

Advanced life support teams responding to out-of-hospital cardiac arrest may face rare and unusual situations in uncontrolled settings, with limited information on the patient they are treating. These teams must have advanced knowledge of all the usual and unusual pathologies that could be found as first responders in the community setting.[1] This case report describes the percutaneous injury experienced by a physician responding to an out-of-hospital cardiopulmonary arrest while administering chest compressions.

Nontransport Rapid Deployment Background

Rapid deployment vehicle teams in Madrid, Spain, are composed of a physician, nurse, and a driver who also has basic Emergency Medical Services training. These rapid deployment teams are equipped with vehicles such as vans with all the materials and equipment of a fully equipped intensive care ambulance. However, these rapid deployment teams do not have the capacity to transfer patients. Their objective is to reach the incident as quickly as possible and begin the health care procedures and stabilization of the patient as soon as possible while the ambulance or further support, if required, arrives.

Patient Information

An emergency call was received on 112 (similar to United States 911) in Madrid in 2019, informing dispatch of a 76-year-old male patient with cardiorespiratory failure in a park. His medical history included arterial hypertension, ischemic heart disease with bypass from acute myocardial infarction to anterior descent, and saphenous to right coronary 15 years ago, presenting with diabetes mellitus and renal failure.

Diagnostic Assessment

Bystanders who saw the patient fall unconscious and called 112 informed the team that they had not performed basic cardiopulmonary resuscitation (CPR). Upon the arrival of the rapid deployment vehicle Advanced Life Support team, 7 minutes after the call was received, advanced resuscitation maneuvers were begun. This case fell under the code 0 procedure, which indicates that in the case of an unconscious patient where the medical Emergency Medical Services' arrival time is under 10 minutes, resuscitation techniques should be administered to restore vital signs or maintain organ perfusion for potential organ donation.

The patient's airway was opened and supported with orotracheal intubation by the physician; intravenous access

and drug treatment protocol were begun by the nurse, and chest compressions were started by the medical technician. The patient's initial cardiac rhythm was asystole.

Once the airway was secured, the clinician team rotated turns to provide chest compressions. Chest compressions were first performed by the medical technician and then the physician.

During the first rotation of physician administered chest compressions, the physician noticed punctures in the palm of the hand that was in contact with the patient's sternal surface, and a lump was observed in the central area of the sternum (similar to Figures 1 and 2). She realized that the nitrile glove was broken in the area of the palm of the hand, and when she removed it, she noted a puncture wound in the thenar region of her right hand.

Therapeutic Intervention and Patient Outcome

Unaware of the origin of these wounds to the physician's hand, the clinical team thoroughly examined the patient's chest. During this assessment, a surgical scar was observed under the patient's chest hair. The clinician team then observed that the median sternotomy wire from the patient's chest had penetrated the skin. The wire tip could be seen with the naked eye. The point of the sternotomy wire that appeared was no longer than 0.5 cm from the surface of the patient's skin. This observation was consistent with the published literature, given that it is described that sternal wire can change position when under pressure.[1] In this case, the sternal wire changed position during the initial chest compressions during the medical technician's rotation.

The team tried to protect themselves from further injury by using a pack of 10 × 10 cm 12-ply sterile gauze to cover the protruding sternotomy wire and continued chest compressions. After 25 minutes of advanced life support, resuscitation maneuvers were suspended. The patient's death was certified.

Discussion

This case report presents a novel contribution to the published literature and advances standard precautions considerations in patients with out-of-hospital cardiac arrest, with the patient's sternotomy wire from previous surgery as a source of percutaneous clinician injury during chest compressions. Median sternotomy is a surgical technique performed during cardiac and pulmonary surgeries.[2] The sternum is closed with a wire suture at the completion of the surgery.

The wires used in a medial sternotomy have been described[3] as capable of a slight rotation under pressure, which can cause the wire to be palpable from the skin, externally. If chest compressions are conducted on a patient who has undergone a sternotomy, the wire can rotate sufficiently to point outward and puncture the patient's skin and subsequently the clinician's hands performing the chest compressions. Chest compressions are reportedly contraindicated in patients who have undergone recent sternotomy.[4] This precaution is meant to prevent excess stress at the surgical site and prevent the breakage or movement of the wires used for the suture. Although medial sternotomy is a well-described technique with many options for suture, procedures performed more than 10 years ago commonly used the sternal wire.[1] The possibility of this wire migrating or moving when handled or placed under pressure has also been described.[5] What has not been previously described is that this happens during chest compressions owing to a CPR technique.

There are 2 published cases pertinent to this present case. The first is an abdominal CPR technique[6] in a patient with a very recent median sternotomy to avoid dehiscence and potential rupture of the sternum. The second case is that of a 44-year-old male who presented with chest pain and a lump in the neck, which X-ray revealed to be the point where the sternal wire had broken.[7] We found no other similar cases reported in the published literature, wherein a past, healed sternotomy became a sharps injury risk for clinicians.

Thus, in patients who have undergone a previous medial sternotomy with sternal wire who require chest compressions, we document a risk of injury to the clinician. Prevention can include considerations that (1) chest compressions are contraindicated, (2) use of abdominal CPR techniques, or (3) padding and/or covering the site as we did by applying a full pack of 10 × 10 cm 12-ply sterile gauze to continue chest compressions.

Follow-Up and Clinician Outcomes

After resuscitation was discontinued and we confirmed that the nitrile gloves and the skin of the physician had been punctured, follow-up according to the protocol for the accidental puncture in interventions with patients was initiated.

Although the patient was considered at low risk, it should be noted that 30- to 40-year-old surgical procedures present a risk of viral contagion exposure such as hepatitis or human immunodeficiency virus, which are some of the main sharps injury-related blood and body fluid exposure infection risks to health workers.[8]

Following the standard postexposure prophylaxis procedures for percutaneous injury exposure,[9] the injured physician was taken for blood tests for human immunodeficiency virus, hepatitis B virus, and hepatitis C virus. The results were negative for bloodborne infectious-contagious diseases. Because this was a single case involving exposure to only one clinician, no further postexposure prophylaxis protocols or procedures were applied to the other members of the emergency response team whose skin remained intact.

Author Disclosures

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This case report adheres to Elsevier's Patient Consent Policy.

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Respiratory Care Innovation in Times of Crisis: JEN

Srinivasan, Shriya S

ABSTRACT (ENGLISH)

System-based modifications such as resistors, clamps, and valves have enabled varying levels of control in carefully matched patients.10,11 In addition, the ability to monitor, overcome ventilator self-tests, exposure, and alarms have been overcome by recent systems.11 Splitting high flow oxygen delivered by a mask or a nasal cannula is certainly less risky, although the rate of oxygen consumption would be increased without special valving leading to accelerated depletion of oxygen reservoirs. In 2021, insufficient oxygen reserves and widespread use for COVID-19 patients created drastic shortages, leading to increased mortality in India.12 Technologies to cost-effectively expand high-flow nasal oxygen systems without wastage would benefit health care infrastructures experiencing high caseloads.—Shriya S. Srinivasan, PhD, Department of Mechanical Engineering, Massachusetts Institute of Technology, Division of Gastroenterology, Hepatology and Endoscopy, Brigham and Women's Hospital, Harvard Medical School, David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology, Project Prana Foundation, Cambridge 02139, Boston 02115, MA, United States; E-mail: shriyas@mit.edu. Twitter:

rajibmndl; Khalil B. Ramadi, PhD, Department of Mechanical Engineering and David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology; Division of Gastroenterology, Hepatology and Endoscopy, Brigham and Women's Hospital, Harvard Medical School; Project Prana Foundation, Cambridge 02139, MA, United States.

FULL TEXT

Dear Editor:

The COVID-19 pandemic has led to a global health care crisis and put unprecedented pressure on our health care system with more than 75 million confirmed cases, 3 million hospitalizations, and 900,000 COVID-19 associated deaths in the United States alone over the past 2 years.[1] The novel disease came with 2 immediate challenges: (1) building disease-specific diagnostics, therapeutics, and preventive measures, and (2) increasing care capacity to treat those with severe courses of the disease.

For both challenges, innovation has turned out to play a key role, most prominently demonstrated by the rapid development of the COVID-19 vaccines. In the current issue's letter to the editors, Duprez et al[2-4] have focused on increasing respiratory care capacity and developed a device that can reduce oxygen consumption during high-flow oxygen treatment, which is often administered in patients suffering from shortness of breath and hypoxemia.[2-4] Reducing oxygen consumption would increase the number of patients who can be served in scarcely resourced areas. During a pandemic such settings rapidly transition to triage-based care, as evidenced in India in spring 2021.[5]

Expedited Regulatory Framework for Pandemic Innovations

Medical innovation enters the United States market after being thoroughly tested for safety and efficacy and receiving regulatory approval by the Food and Drug Administration (FDA), which can be a multi-year process. However, emergency situations require a dynamic response to rapidly changing circumstances. To enable such a response, the FDA has implemented the "emergency use authorization". The emergency use authorization allows rapid approvals for otherwise unapproved medical products or unapproved usage of approved medical products to be used in an emergency to diagnose, treat, or prevent serious or life-threatening diseases or conditions. Under the ventilator and ventilator accessories section, a set of guidelines was provided to assist and evaluate the safety and efficacy of modified devices.[5,6] Other nations' regulatory bodies issued similar modified processes to enable the rollout of life-critical technologies during the pandemic.

Human clinical trials can be challenging to perform during health care crises. Instead, simulators such as the Michigan test lung system and computational analyses can provide robust validation methods.[7,8] Conformance with applicable International Electrotechnical Commission and International Organization for Standardization standards further increase reliability and safety of the device. The FDA also requires clear device labeling and safety alarm functionalities, which is particularly important in ventilators and ventilator modifiers.

An Innovative Approach to Reduce Oxygen Consumption In High-Flow Therapy

Duprez et al[4] suggest a simple-to-implement and innovative modification of commercial nasal cannulas to further increase the oxygen concentration in inhaled air by reducing the amount of dilution with room air. At its core, the modification consists of a reservoir for oxygenated air from the cannula. Instead of being lost to room air at times other than inspiration, the oxygenated air is pooled inside the reservoir. This is similar in some ways to a nonrebreather mask with a reservoir bag to pool oxygenated air prior to delivery.

The technology mentioned was first described in 1991 in a similar form. Early studies showed that such a simple adaptation could increase partial pressure of oxygen in patients without increasing partial pressure of carbon dioxide, showing that expired air is in fact pushed out of the reservoir trunks by incoming cannula airflow. This double-trunk mask was also shown to be as, if not more, efficient than the nonrebreather mask at maintaining and improving partial pressure of oxygen.[8,9]

The authors have previously shown how this design can improve oxygenation during high-flow nasal oxygen cannula therapy.[2] In this letter,[4] the authors highlight how this might be used to conserve oxygen supplies in resource-limited settings to supplement low flow nasal cannula oxygen therapy. This is of particular note given how

the COVID-19 pandemic has stretched health delivery globally. Assuming a hypoxemic patient takes 30 breaths per minute and is on low flow of oxygen of 900L/h, such a device could reduce source oxygen utilization by 21%.
A question that remains, given the long history of testing such a double-trunk mask, is why both trunks have been kept the same diameter and length. In theory, increasing trunk length would increase reservoir capacity, further reducing oxygen consumption. It seems that the airflow and fluid dynamics of this device would benefit from a more thorough understanding.

Considerations for Modifying Respiratory Devices

The modification of respiratory devices is accompanied by numerous technical and safety challenges, such as cross contamination, patient-specific needs for pressure and volume support, and alarm management. During the COVID-19 pandemic, respiratory devices were multiplexed to manage the overwhelming case load experienced by some hospitals. In such cases, independent control of volume and pressure to each patient is critical for lung-protective ventilation, the standard of care for acute respiratory distress syndrome. In most multiplexed devices, the compliance and resistance of the patients become part of the same circuit and therefore must be managed with modifications that can manipulate the interdependence. System-based modifications such as resistors, clamps, and valves have enabled varying levels of control in carefully matched patients.[10,11] In addition, the ability to monitor, overcome ventilator self-tests, exposure, and alarms have been overcome by recent systems.[11]
Splitting high flow oxygen delivered by a mask or a nasal cannula is certainly less risky, although the rate of oxygen consumption would be increased without special valving leading to accelerated depletion of oxygen reservoirs. In 2021, insufficient oxygen reserves and widespread use for COVID-19 patients created drastic shortages, leading to increased mortality in India.[12] Technologies to cost-effectively expand high-flow nasal oxygen systems without wastage would benefit health care infrastructures experiencing high caseloads.—*Shriya S. Srinivasan, PhD, Department of Mechanical Engineering, Massachusetts Institute of Technology, Division of Gastroenterology, Hepatology and Endoscopy, Brigham and Women's Hospital, Harvard Medical School, David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology, Project Prana Foundation, Cambridge 02139, Boston 02115, MA, United States; E-mail*: shriyas@mit.edu. ***Twitter:*** ShriyaSrinivas3*; Rajib Mondal, Harvard-MIT Division for Health-Sciences and Technology, Research Laboratory of Electronics, Massachusetts Institute of Technology, McGovern Institute for Brain Research, Massachusetts Institute of Technology, Project Prana Foundation, Cambridge, MA 02139, United States; E-mail:* rmondal@mit.edu. ***Twitter:*** rajibmndl*; Khalil B. Ramadi, PhD, Department of Mechanical Engineering and David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology; Division of Gastroenterology, Hepatology and Endoscopy, Brigham and Women's Hospital, Harvard Medical School; Project Prana Foundation, Cambridge 02139, MA, United States. Division of Engineering, New York University Abu Dhabi, Abu Dhabi, United Arab Emirates; E-mail:* kramadi@mit.edu. ***ORCID identifier:*** https://www.doi.org/0000-0002-5864-2386.

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Emergency Nurse Certification: JEN

ABSTRACT (ENGLISH)

The nurse workforce consists of people with varying levels of education and experience in specialty areas.1 Nurses often seek to distinguish clinical and professional expertise through specialty certification.2,3 As the healthcare environment is becoming more complex, some healthcare leaders are advocating for specialty certification as a national standard to increase nurses' professional standing and prepare nurses to better meet the specific needs of the patient populations they serve.4 Board certification demonstrates excellence and recognition of the specialized knowledge, skills, and clinical judgement validated by the achievement of standards identified by nursing specialty to promote optimal health outcomes.5 The first large-scale, rigorous study examining the value of emergency nursing certification to nurses, their patients, and their employers, “The Value of Certification Study,” was conducted by the Human Resources Research Organization and commissioned by the Board of Certification for Emergency Nursing (BCEN).6 Study results were based on survey data from over 8,800 certified and non-certified emergency nurses and over 1,000 emergency supervisors. Previously, ENA has collaborated with stakeholders, including the American Academy of Emergency Nurse Practitioners (AAENP) and the National Association of Clinical Nurse Specialists, to further establish core competencies and expand opportunities for APRNs in the emergency setting.20,21 In 2019, the ENA Position Statement, Advance Practice Registered Nurses in the Emergency Setting, established the importance of APRNs in the ED setting and outlined gaps in national certifications.22 AAENP developed a strategic partnership with ENA to establish the emergency nurse practitioner (ENP) specialty scope and standards, thereby paving the way for professional certification mechanisms.17,23 Emergency nurse practitioners may attain an Emergency Nurse Practitioner Certification (ENP-C) through a program offered by the American Academy of Nurse Practitioners in collaboration with AAENP.24 For clinical nurse specialists (CNSs) who practice in the emergency setting, there is currently no emergency certification method for the CNS APRN role. [...]variations in practice, which take into account the needs of the individual patient and the resources and limitations unique to the institution, may warrant approaches, treatments and/or procedures that differ from the recommendations outlined in this position statement. [...]this position statement should not be construed as dictating an exclusive course of management, treatment or care, nor does adherence to this position statement guarantee a particular outcome.

FULL TEXT

Description

Emergency nurses play a pivotal role in providing quality care and improving patient outcomes. The nurse workforce consists of people with varying levels of education and experience in specialty areas.[1] Nurses often seek to distinguish clinical and professional expertise through specialty certification.[2,3] As the healthcare environment is becoming more complex, some healthcare leaders are advocating for specialty certification as a national standard to increase nurses' professional standing and prepare nurses to better meet the specific needs of the patient populations they serve.[4] Board certification demonstrates excellence and recognition of the specialized knowledge, skills, and clinical judgement validated by the achievement of standards identified by nursing specialty to promote optimal health outcomes.[5]

The first large-scale, rigorous study examining the value of emergency nursing certification to nurses, their patients,

and their employers, “The Value of Certification Study,” was conducted by the Human Resources Research Organization and commissioned by the Board of Certification for Emergency Nursing (BCEN).[6] Study results were based on survey data from over 8,800 certified and non-certified emergency nurses and over 1,000 emergency supervisors. Outcomes of value from Certified Emergency Nurse (CEN) certification to emergency nurses included the following: higher annual pay, job advancement, employability, and nursing self-efficacy, even after controlling for level of education and years of experience. These results support prior studies that reported specialty certifications in nursing are associated with increased nurse satisfaction and empowerment.[7–9] In the “Value of Certification Study,” employers of nurses with CEN certification reported multiple aspects of greater technical performance, accuracy, and ethical behavior for those certified than those not certified.[6] Nurses with specialty certification are more likely to leverage their knowledge and power to make independent clinical judgments regarding the need for patient vital signs and the impact of variation on patient care.[10] Further, engaging nurses with CEN in process improvement efforts to reduce hemolysis in blood samples is beneficial as these nurses are likely better informed on evidence-based practices.[11] Researchers found possible linkage of specialty certification with improved patient outcomes.[7,8,12–16]

Certification has additional meaning for APRNs as licensure and certification are often linked, requiring certification as a mandate for entry into practice.[2,17,18] The APRN Consensus Workgroup supports the link between licensure and certification.[19] The Consensus Model for advanced practice registered nurses (APRN) regulation outlines the standard accreditation, education, certification, and licensure throughout the United States, with the goal of attaining full practice authority for APRNs.[19]

ENA Position

It is the position of the Emergency Nurses Association (ENA) that:

1. Specialty certification validates advanced knowledge, competence, and commitment to excellence in emergency nursing.
2. Attainment of emergency nursing certification contributes to the delivery of safe, effective, quality care.
3. Development of validation methods for advanced emergency certification to facilitate the meeting of licensure requirements by APRNs is essential.
4. Practice environments that encourage and facilitate emergency nursing certification and continuing education opportunities promote improved patient outcomes and greater professional satisfaction.
5. Certification and credentials integrated into professional advancement models are a means to recognize specialized knowledge, leadership, and clinical judgment.
6. Healthcare institutions support both the initial certification and renewal certification of their emergency nursing workforce.
7. Nurses who have successfully achieved specialty certification have earned the privilege to use and professionally display credentials following their name, including on their identification badges.
8. Research specific to and regarding the relationship of emergency nursing certification to safe, effective, quality practice, and to both nurse and patient satisfaction is essential.

Background

In the complex, time-pressured, and dynamic environment of emergency care, emergency nurses engage in continuing education to remain aware of current knowledge and best practices. Specialty certification is a method for validating the knowledge, skills, and competencies unique to specific populations supported by the National

Academy of Medicine (formerly the Institute of Medicine)[1] and is recognized as a strong benchmark of quality in Magnet-recognized organizations.[8] Registered nurses in the emergency setting may attain specialty certification by exam through the BCEN as a generalist (CEN), flight nurse (CFRN), critical care ground transport nurse (CTRN), pediatric emergency nurse (CPEN), and trauma nurse (TCRN).[5]

Certification for APRNs in the emergency setting is evolving. Previously, ENA has collaborated with stakeholders, including the American Academy of Emergency Nurse Practitioners (AAENP) and the National Association of Clinical Nurse Specialists, to further establish core competencies and expand opportunities for APRNs in the emergency setting.[20,21] In 2019, the ENA Position Statement, *Advance Practice Registered Nurses in the Emergency Setting*, established the importance of APRNs in the ED setting and outlined gaps in national certifications.[22] AAENP developed a strategic partnership with ENA to establish the emergency nurse practitioner (ENP) specialty scope and standards, thereby paving the way for professional certification mechanisms.[17,23] Emergency nurse practitioners may attain an Emergency Nurse Practitioner Certification (ENP-C) through a program offered by the American Academy of Nurse Practitioners in collaboration with AAENP.[24] For clinical nurse specialists (CNSs) who practice in the emergency setting, there is currently no emergency certification method for the CNS APRN role.

Barriers regarding the value of specialty nursing certification include the lack of a universal taxonomy for professional certifications in nursing and the complexity of research that enables merging of nurse, patient, and institution-specific data.[1,12] Large scale, generalizable research that examines the value of specialty nursing certification to patient outcomes is complex. It requires the merging of information from large datasets, such as the National Database of Nursing Quality Indicators, which captures nursing- and unit-specific data, with information from others, such as the Centers for Disease Control and Prevention's National Healthcare Safety Network or the Hospital Consumer Assessment of Healthcare Providers and Systems Survey, which capture patient outcome data.[12]

In today's value-based healthcare system, organization payment and, at times, provider compensation are linked to patient quality outcomes, including nurse-sensitive quality indicators. Professional certification benefits the individual emergency nurse, the patients they serve, and the healthcare institution. Existing data suggest that a relationship between certification and patient outcomes exists but is not fully understood and requires further investigation.[25] However, the intrinsic rewards of professional certification, such as the sense of competence and empowerment it offers nurses and the credibility it offers healthcare institutions, are well supported by the existing literature.[5]

Disclaimer

This position statement, including the information and recommendations set forth herein, reflects ENA's current position with respect to the subject matter discussed herein based on current knowledge at the time of publication. This position statement is only current as of its publication date and is subject to change without notice as new information and advances emerge. The positions, information and recommendations discussed herein are not codified into law or regulations. In addition, variations in practice, which take into account the needs of the individual patient and the resources and limitations unique to the institution, may warrant approaches, treatments and/or procedures that differ from the recommendations outlined in this position statement. Therefore, this position statement should not be construed as dictating an exclusive course of management, treatment or care, nor does adherence to this position statement guarantee a particular outcome. ENA's position statements are never intended to replace a practitioner's best nursing judgment based on the clinical circumstances of a particular patient or patient population. Position statements are published by ENA for educational and informational purposes only, and ENA does not "approve" or "endorse" any specific sources of information referenced herein. ENA assumes no liability for any injury and/or damage to persons or property arising out of or related to the use of or reliance on any position

statement.

Resources

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DETAILS

Subject:	Research; Emergency medical care; Continuing education; Workforce; Clinical standards; Clinical skills; Health status; Nurse practitioners; Leadership; Emergency services; Clinical nursing; Advanced practice nurses; Patient satisfaction; Clinical outcomes; Certification; Nurse specialists; Quality standards; Clinical nurse specialists; Human resources; Knowledge; Empowerment; Specialists; Emergency nurse practitioners; Education; Supervisors; Clinical decision making
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Emergency Evaluation of Nonfatal Strangulation Patients: A Commentary on Controversy and Care Priorities: JEN

ABSTRACT (ENGLISH)

Both leave few marks, both can result in loss of consciousness, both are used to assert dominance and authority over the life of the other, both create intense fear and potentially result in death and both can be used repeatedly, often with impunity.2Poststrangulation Diagnostic Imaging Computed tomographic angiography (CTA) is considered the preferred screening test to evaluate cervical vasculature for blunt cerebrovascular injuries (BCVIs).13-15 However, determining which poststrangulation patients should receive CTA to maximize utility and minimize risk is a topic of controversy. Increased incidence of thyroid cancer has been observed in patients exposed to high-dose radiation from atomic weapons or nuclear power plant accidents. [...]there is continued discussion in the literature about whether or not the increased incidence of thyroid cancer is associated with or caused by increased use of diagnostic computed tomography scans. Radiation specific studies have calculated the estimated cancer risk from CTA of the neck to be a maximum of 36 cancers per 1,000,000 studies or 0.0036% for a single CTA.23 The authors of the Eastern Association for the Surgery of Trauma PMGs concluded that this risk was outweighed by the benefits of diagnosing BCVI using a liberal or universal CTA screening protocol.15 We are unaware of any existing research on the psychological burden CTAs pose to patients presenting after strangulation.

FULL TEXT

Strangulation–external pressure applied to the neck that compromises blood flow, air flow, or both–is a common occurrence in the setting of interpersonal violence.[1,2] As emergency nurses and prescribers have become increasingly aware of the prevalence and negative health outcomes of strangulation, practice and research teams have begun to explore best practices for evaluation of these patients.

In this issue of the *Journal of Emergency Nursing*, Stellpflug et al[3] describe characteristics of strangulation patients evaluated in a sexual assault nurse examiner (SANE) program. Findings presented in this retrospective medical record analysis emphasize the varied presentations, assessments, and treatment approaches for this vulnerable population. Consistent with data reported in other literature, documented symptoms include loss of consciousness (LOC) or near-LOC.[4,5] Recognizing that carotid artery occlusion can result in asphyxial LOC within 5 to 10 seconds and death in minutes,[1,6] the critical need for coordinated emergency evaluation and response is clear. This manuscript adds to the growing literature on strangulation and highlights 2 important considerations for emergency care of these patients: appropriate diagnostic imaging evaluation and variability in clinical documentation.

The Mechanism of Strangulation

Blunt force trauma to the neck, such as strangulation, can cause cerebrovascular injury through 3 main mechanisms: arterial stretching, arterial twisting and direct compression of the artery.[7] Injury usually begins with intimal tearing and is frequently followed by a silent, or latent, period of hours, days, weeks, months or, rarely, years before evolving and creating neurologic damage (usually a thrombotic or embolic stroke).[7-10]

Focal, posteriorly directed force to the neck compresses the carotid arteries against the underlying transverse processes of the cervical vertebrae.[11] Simultaneous, bilateral compression of both carotid arteries can stop or significantly decrease blood flow to the brain, resulting in LOC or near-LOC. A lack of cerebral perfusion can also result in anoxic brain injury that may present in very subtle or more overt ways. These mechanistic risks exist for strangled patients as they do for other trauma victims sustaining blunt neck trauma as strangulation is, by definition, a type of blunt force neck trauma.

The physical injuries associated with strangulation are not the only consequences of concern. Strangulation as a mechanism to impart such rapid physical control makes it a tool of choice for perpetrators of violence looking to control others.[12] *Nonfatal strangulation might well be the equivalent of water boarding, widely considered as torture. Both leave few marks, both can result in loss of consciousness, both are used to assert dominance and authority over the life of the other, both create intense fear and potentially result in death and both can be used repeatedly, often with impunity.*[2]

Poststrangulation Diagnostic Imaging

Computed tomographic angiography (CTA) is considered the preferred screening test to evaluate cervical vasculature for blunt cerebrovascular injuries (BCVIs).[13-15] However, determining which poststrangulation patients should receive CTA to maximize utility and minimize risk is a topic of controversy. Arguments against liberal or universal use of CTA to detect poststrangulation vascular injury have included: rarity of clinically significant findings; unnecessary radiation exposure increasing long-term cancer risk; expense of testing and reimbursement challenges; and additional psychological burden to patients. These concerns, also echoed in this current paper, are important considerations for both patients and ED operations.

In the United States, evidence based BCVI practice management guidelines (PMGs) endorse screening all symptomatic patients, and asymptomatic patients with certain risk factors, including those that can be experienced during strangulation (eg, near hanging with cerebral anoxia, clothesline-type injury [laryngeal injury]).[15] Updated in 2020, Eastern Association for the Surgery of Trauma PMGs further support screening patients with an injury involving severe cervical hyperextension/rotation or hyperflexion, which may also be inflicted during a strangulation-related assault. Other large studies of various trauma have reported that liberal or universal CTA, as compared to BCVI clinical screening criteria (eg, Denver, Memphis), significantly increases detection of BCVI, further underscoring the diagnostic performance limitations of selective clinical screening criteria.[13,14] These studies found rates of BCVI ranging from 2.2% to 2.7% and noted that using clinical screening protocols instead of liberal CTA use

would have missed approximately 20% to 50% of BCVIs.

In addition, there are a small but growing collection of manuscripts specifically dedicated to examining cohorts of patients who were strangled.[16-20] These studies present relatively smaller samples of patients seeking care after strangulation and report rates of positive vascular findings on CTA ranging from 1.0% to 2.1%. Notably the MacDonald et al[19] study presented a rate of 15.4% but only completed CTAs on a very small percentage of their sample (6%), so we have excluded it from our overall range. These studies were all retrospective chart reviews, limiting the available information to that which was previously documented, and reflected wide clinical practice variation in using CTA/magnetic resonance imaging for BCVI detection (see [Table] for BCVI considerations for health care clinicians).

Measurement bias is of particular concern, because not all strangled patients were screened using CTA and those not screened may falsely be assumed to have no findings. Rates of documented CTA in most of the strangulation-specific studies ranged from 6% to 60%,[16,18-20] in contrast to 100% CTA use in the larger cohorts of general trauma patients (inclusive of strangulation). In these 2 studies, liberal or universal CTA protocols performed significantly better than the tested clinical screening or PMGs.[13,14] Thus, using clinical indicators or “suspicion” alone to determine who may or may not have a BCVI, and thereby who should or should not receive CTA screening, is not supported by the current evidence.

Stellpflug et al[3] also warn of many potential risks of CTA including cancer risk from radiation exposure and unnecessary psychological stress, among other concerns. The risk of cancer, particularly given the susceptibility of the thyroid gland to radiation, is raised when considering use of a diagnostic screening tool such as CTA for BCVI. Increased incidence of thyroid cancer has been observed in patients exposed to high-dose radiation from atomic weapons or nuclear power plant accidents. This is, of course, not the same as exposure to radiation from diagnostic imaging. As a result, there is continued discussion in the literature about whether or not the increased incidence of thyroid cancer is associated with or caused by increased use of diagnostic computed tomography scans. Radiation specific studies have calculated the estimated cancer risk from CTA of the neck to be a maximum of 36 cancers per 1,000,000 studies or 0.0036% for a single CTA.[23] The authors of the Eastern Association for the Surgery of Trauma PMGs concluded that this risk was outweighed by the benefits of diagnosing BCVI using a liberal or universal CTA screening protocol.[15]

We are unaware of any existing research on the psychological burden CTAs pose to patients presenting after strangulation. Conclusions about psychological burden should not be made without evidence to substantiate this claim and should not be drawn from research on other types of surveillance testing (such as breast mammography or low dose computed tomography screening for lung cancer in heavy smokers). To the contrary, there is evidence that intervention with a SANE can increase patient satisfaction, especially when the SANE is empathetic and the patient feels believed. Ordering a CTA may, in fact, convey a sense of validation for the patient.[24,25]

Although we concur that the potential risks raised may be real, we also want to highlight that they are almost entirely unstudied in this context and population. Further study regarding actual versus perceived risk is needed before commenting on the status of a CTA and its burden to patients and providers in the setting of poststrangulation assessment. These risks must also be balanced against the established risk of a silent, evolving BCVI (1.0%-2.7%) that is easily detectable in the asymptomatic latent interval, treatable with oral medication that offers a high likelihood of preventing neurologic compromise and, if missed, risks stroke or death.

Documentation Concerns

The authors’ recommendations also emphasize the need for improved documentation guidelines.[3] Inconsistent or missing documentation of evaluation and treatment elements is a known limitation of retrospective reviews. Notably, the authors of the current publication found missing data of up to 96% in the chart fields they reviewed.[3] This highlights that, although retrospective chart reviews play an important role in data collection about current practice, they cannot act as a substitute for prospective patient-centered research. In another example, a 2022 publication demonstrates that, even in a sample of known nonfatal strangulation patients presenting for ED and forensic care, strangulation was only included in final diagnosis or billing codes for 27.8%, further emphasizing how inconsistent

documentation can be.[26]

Numerous challenges face the nurses, physicians, and other health care providers who care for patients after strangulation–often in an intense, time-pressured and resource-pressured ED setting. Expert recommendations for strangulation clinical assessment and documentation exist,[27-29] which can inform the development of robust electronic solutions to more efficiently and effectively help ED teams capture this important information. Subsequently, more widespread adoption of strangulation assessment tools in electronic health records and consistent use of strangulation-related diagnostic classification codes are important steps toward collecting these data for individual, high-quality, longitudinal care and public health research.

Conclusion

Stellpflug et al[3] have added to the small but growing literature describing patients presenting for care after surviving strangulation. However, we strongly advise readers to consider methodological limitations when evaluating the BCVI evaluation recommendations put forward. This study used retrospective chart reviews with significant practice and documentation variability and very few patients undergoing CTA of the neck.

Many researchers, including 3 decades of trauma surgery investigators, have struggled to develop reliable decision rules to predict risk of cerebrovascular injury after blunt trauma using injury mechanisms, history and physical examination findings. To date, no decision rule on this issue has proved accurate enough to be relied upon in clinical practice to safely exclude patients at potential risk for cerebrovascular injury from CTA screening.[13,14] We strongly agree with the authors that further research to develop and rigorously test reliable decision rules for diagnostic imaging of patients surviving strangulation is needed.

However, we respectfully disagree that the findings presented, specifically a lack of documented major injuries in the 13 of 130 strangled patients (10%) screened with CTA of the neck, support selective use of CTA in this population. With an estimated BCVI prevalence of 1% to 2% and a full patient cohort of 130, we would expect that if all of these patients received CTA screening, at least 1 or 2 would have been found to have a vascular injury. One may not sound like a very high number, but if that one person is your loved one, doing everything possible to save their life suddenly becomes very important and, again, only 10% of the patients included in this study received a neck CTA. Although subsequent electronic health records visits from 89 of 130 patients (68.5%) within their health system were identified, none with stroke or cervical artery dissection in their medical problem list, this single data point does not provide adequate reassurance that there were no missed cerebrovascular injuries or delayed strangulation complications.

Given the recognized risk of cerebrovascular injury (and potential for resultant neurologic compromise or death) after strangulation, coupled with the limitations of predictive clinical screening criteria for BCVI at this time, we continue to support the use of liberal or universal CTA protocols to evaluate poststrangulation patients.

Author Disclosures

Conflicts of interest: none to report.

•BCVI mechanisms (ie, crushing, twisting, stretching) are the same as those involved in strangulation.
•Currently, even the most complete history and physical exam cannot reliably differentiate who does and does not have a BCVI.[13,14,21]
•CTA is a widely available, brief, and well tolerated procedure for detecting BCVI.
•Undiagnosed (or untreated) BCVI may lead to devastating neurologic sequelae or death.

•If diagnosed early, most BCVI lesions can be effectively treated, and neurologic compromise prevented, with anticoagulation therapy (most commonly oral antiplatelet drugs).[15]
•Patients with BCVI may present deceased, or with a spectrum of neurologic symptoms and findings, or may be completely asymptomatic.[22]
•Patients with BCVI may present with significant physical findings, such as bruising, or no findings at all.[13,14,17,21]
•The interval between vascular injury and neurologic deterioration (the latent or “silent” period) may be minutes, hours, days, or even months.[7,8]
•This latent period offers an important clinical opportunity to diagnose the vascular lesion and intervene therapeutically to prevent subsequent neurologic deterioration.
•The risk of BCVI after external neck trauma (including compressive trauma) is low (approximately 1.0%-2.7% across trauma patient and strangled cohorts), but not zero.[13,14,16-20,21]

DETAILS

Subject:	Carotid arteries; Emergency medical care; Thyroid cancer; Tomography; Accidents; Disputes; Neck; Documentation; Asymptomatic; Injuries; Sex crimes; Radiation; Nuclear power plants; Patient satisfaction; Psychological trauma; Trauma; Nuclear energy; Angiography; Consciousness; Surgery; Weapons; Veins &arteries; Nuclear accidents &safety; Strangulation; Dominance; Fainting; Medical screening
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Providing Hearing Assistance to Veterans in the Emergency Department: A Qualitative Study: JEN

ProQuest document link

ABSTRACT (ENGLISH)

Introduction

Effective communication is essential to good health care, and hearing loss disrupts patient-provider communication. For the more than 2 million veterans with severe hearing loss, communication is particularly challenging in noisy health care environments such as emergency departments. The purpose of this qualitative study was to describe patient and provider perspectives of feasibility and potential benefit of providing a hearing assistance device, a personal amplifier, during visits to an emergency department in an urban setting affiliated with the Department of Veterans Affairs.

Methods

This qualitative descriptive study was conducted in parallel with a randomized controlled study. We completed a semistructured interview with 11 veterans and 10 health care providers to elicit their previous experiences with patient-provider communication in the ED setting and their perspectives on hearing screening and using the personal amplifier in the emergency department. Interview data were analyzed using content analysis and Atlas.ti V8.4 software (Scientific Software Development GmbH, Berlin, Germany).

Results

The veteran sample (n = 11) had a mean age of 80.3 years (SD = 10.2). The provider sample included 7 nurses and

3 physicians. In the ED setting, hearing loss disrupts patient-provider communication. Screening for hearing loss in the emergency department was feasible except in urgent/emergent cases. The use of the personal amplifier made communication more effective and less effortful for both veterans and providers.

Discussion

Providing the personal amplifier improved the ED experience for veterans and offers a promising intervention that could improve health care quality and safety for ED patient populations.

FULL TEXT

Contribution to Emergency Nursing Practice

••Hearing loss is highly prevalent among veterans; noise pollution in the emergency department interferes with patient-provider communication and challenges ED care for older veterans. Caring for older veterans in the emergency department is complicated by the influence of aging on symptomatology of disease, multiple chronic conditions, and unmet physical and social needs. In general, those with hearing loss report worse communication with their health care providers and overall poorer health care quality; they also have increased ED recidivism and hospitalization rates.

••The main finding of this paper is that in the VA ED setting, hearing loss influences veteran-provider communication and current approaches are inadequate to address this gap in care. Screening for hearing loss in the emergency department was feasible except in urgent/emergent cases, and providing a hearing assistive device was perceived as very beneficial in that it improved the ED experience for veterans and clinicians.

••Recommendations for translating these findings into emergency clinical practice include implementation of point-of-care hearing assessment that is integrated with medical intake or history taking to identify undiagnosed or untreated hearing loss. Providing the use of a low-cost, easy-to-use point-of-care personal amplifier can facilitate effective veteran-provider communication in the emergency department that includes assessment, treatment, and postdischarge instructions.

Introduction

Effective communication is a cornerstone of health care, and patients with hearing loss often struggle to hear and understand their health care providers. For the more than 30 million Americans[1,2] with bilateral hearing loss, communication is particularly challenging in noisy clinical environments such as emergency departments.[3-5] Age-related hearing loss is highly prevalent; 25% of adults between 60 and 69 years of age and 80% of those older than 80 years of age have bilateral disabling hearing loss.[6,7] ED visit rates also increase significantly with age and multiple comorbid conditions often complicate ED presentations of older adults.[8] For many older adults seeking care in the emergency department, hearing loss interferes with speech understanding and increases the likelihood of poor communication with providers. The array of noises in an emergency department includes ambient noises emanating from competing conversations between patients and health care providers, beeping sounds from various pieces of electronic equipment, and other noises related to patient admission and processing. Such noise pollution in the emergency department affects patients by compromising patient safety, increasing fatigue and elevating stress owing to the difficulty of and effort required in understanding what others are saying.[9]

Problem Formulation

Hearing loss is of particular importance in the care of our nation’s veterans, who may have a history of significant noise exposure in combat.[10] Notably, Vietnam-era veterans have now crossed the critical >60-year age threshold, when the normal decline of hearing with age may be accelerated by noise exposure history and other risk factors.

Among older veterans, hearing loss is the second most common disability compensation[11] and the most prevalent occupational health disability.[12] More than 2 million veterans have a severe hearing loss; compared with nonveterans of the same age, veterans experience higher rates of hearing loss.[13] The increased risk of hearing loss among veterans is multifactorial. Combat-related service places veterans at risk of excessive noise exposure and earlier onset and greater severity of age-related hearing loss.[12] Tobacco is another veteran-associated exposure.[14] When considering the synergistic effect of age, smoking, and excessive noise exposure, veterans are at much greater risk of hearing loss than the nonveteran population.[15,16]

Notably, 56% of the nation's 19.1 million veterans are more than 60 years old.[17] It is estimated that each year more than 1 million veterans, seek ED care at a VA setting[18,19]; most are older than the age of 60 and nearly 20% are older than the age of 80 years.[18] Similar to nonveteran older adults seeking care in the emergency department, the ED presentation for older veterans is influenced by aging on disease symptomatology and the presence of multiple comorbid conditions.[20,21] Caring for older veterans in the emergency department may take more time and resources owing to unmet physical and social needs[22] including high rates of homelessness.[23] Hearing loss may compound these challenges of ED care for veterans. In general, patients with hearing loss report worse communication with their health care providers and overall poorer health care quality; they also have increased hospitalization rates.[24,25] Unfortunately, screening for impaired hearing is not part of usual ED care. Therefore, older patients with hearing loss have a greater likelihood for poor communication with providers and inadequate preparation for postdischarge care.[26] Collectively, these challenges to effective communication between veterans and providers may contribute to missed or incorrect diagnoses, inadequate discharge plans, and recurring ED visits.

Problem Statement

Despite high prevalence rates among older adults, hearing loss is often underrecognized and undertreated.[27] Screening rates for age-related hearing loss in older adults are as low as 12.9% in primary care settings.[28,29] Hearing aids are the primary treatment for sensorineural hearing loss; however, only approximately 20% of patients who could benefit from this intervention actually use their hearing aids.[30] For veterans, access to comprehensive hearing services and hearing aids are provided through the VA services.[31] However, utilization of hearing aids among veterans is lower than among nonveterans.[32] As a result, many older veterans may present for care in an emergency department without hearing assistance devices.

In the inpatient setting, the most common strategy to facilitate communication with a patient who has untreated hearing loss is with a personal amplifier (PA). This low-cost device consists of a microphone, amplifier, and hardwired headset or ear buds; the provider speaks into the microphone, and the amplified voice is heard by the patient through the headset. PAs reduce the difficulty in "difficult listening situations," by direct amplification of another's voice fed to a patient's ears, making the signal louder than background noise. Clinical reports indicate that PA use can enhance communication with patients who have hearing loss in a variety of clinical settings, including hospitals,[33] nursing homes,[34] and palliative care units.[35,36] In a randomized controlled trial (RCT) of 180 new device users (mean age 74.3 years), the PA was reported as equivalent in performance to hearing aids[37]; sound quality of the PA was judged as preferable to hearing aids.[37] Another study found that providing a PA to older hospitalized patients improved physician-patient communication; only 6% of those provided with a PA reported poor or unsatisfactory patient-provider communication compared with 22% of those who did not receive a device.[38] Given the prevalence of hearing loss in older veterans and increasing prevalence in older adults in general,[39] our multidisciplinary team has begun a series of studies of formal tests of the effectiveness of PAs in health care settings including VA emergency departments.

This qualitative descriptive study was conducted in parallel with an RCT of patients in an urban VA emergency

department.[40] The Hearing Impairment, Strategies and Outcomes in VA (HearVA) study, which is described in detail elsewhere,[40] focused on patients 60 years and older, the age at which age-related hearing loss begins to increase in prevalence.[41] In the HearVA RCT, 133 veterans with hearing difficulty who presented to the emergency department but were likely to be discharged to home were enrolled and randomized to receive the PA intervention with a brief training on its use or usual care and control. The intervention group had improvements in objectively measured communication and reductions in readmission to the emergency department compared with the control group.[40] During the HearVA RCT, we conducted semistructured interviews with veterans, nurses, and physicians about their experiences with hearing loss in the VA emergency department and the acceptability of hearing screening and the use of PAs that were provided to study patients. Because research in the emergency department is uncommon, this qualitative study addresses an important knowledge gap about ED point-of-care interventions to facilitate patient-provider communication in populations with hearing loss.

Verbal Exchange Health Literacy Model

Our research is guided by the verbal exchange health literacy (VEHL) model that elucidates the factors essential for the verbal exchange of health information.[42] VEHL is defined as "the ability to speak and listen that facilitates the exchanging, understanding, and interpreting of health information for health-decision making, disease management and navigation of the health care system."[42(p.6)] According to the VEHL model, a number of factors including patient, provider, relational, and system characteristics influence VEHL, which in turn influences health outcomes. For example, a patient's VEHL influences their understanding of information provided by the provider and their use of this information including adherence to treatment recommendations and discharge instructions. Communication through the aural (ie, hearing) and oral exchange of health information (ie, speaking) between patients and providers is essential to patient care. Hearing loss disrupts these exchanges (ie, the listening component of communication) but may be mitigated through the use of an amplification device. An adapted VEHL model focusing on the listening component ([Figure]) guided the qualitative study and included (1) patient characteristics (hearing loss, attitudes, perspectives, previous experience with hearing aids, communication strategies, and ED setting), (2) provider characteristics (communication strategies, previous experience), and (3) system characteristics (in-ED interactions, access to VA hearing care). The adapted model was used to inform the interview guide, generate a priori codes, and help guide directed content analysis.

Purpose

The purpose of this qualitative descriptive study was to describe patient and provider perspectives of feasibility and potential benefit of providing a hearing assistance device, a PA, during visits to an emergency department in an urban setting affiliated with the Department of Veterans Affairs.

Methods Qualitative Approach

This was a qualitative descriptive study that elicited perspectives of veterans (eg, previous experience, attitudes, preferences, ED experience) and providers (eg, in-ED experience, communication strategies) about hearing screening in the emergency department and the use of a PA as a strategy to facilitate patient-provider communication. The qualitative descriptive design[43] is appropriate to answer specific questions, such as our study purpose; the underlying philosophical orientation is naturalistic inquiry.[43] As such, qualitative descriptive studies may be guided by a theory to varying degrees; in this study, the VEHL model was used to guide data collection and analysis. In qualitative descriptive studies, a common data analytic approach is content analysis; interpretation is low inference given that the intent is to generate an accurate description of the experience.[44] Findings of a qualitative descriptive study have great potential for translation to address important health issues and identify strategies to improve care, for example, developing or refining interventions and addressing health disparities through program

development.[44]

Setting

This study was conducted in a large urban VA emergency department that provides care to more than 12,000 veterans annually. The setting had dedicated space for confidential recruitment and interviews.

Sample

A purposive sample of veterans from the HearVA RCT intervention arm (n = 11) participated in interviews about being screened for hearing loss and their experiences with the PA. Veterans presenting to the emergency department were eligible to participate if they were (1) aged ≥60 years, (2) English speaking, (3) likely to be discharged to home based on the Emergency Severity Index criteria,[45] and (4) scored ≥10 on the Hearing Handicap Inventory –Screen.[46] Individuals were excluded if they had cochlear implants or a cognitive or neurological condition that limited their ability to consent. Maximum variation sampling[47] of veterans was used to ensure that cases provided maximum heterogeneity on key attributes (eg, race, age, and sex) that could be important in understanding utility of the device. The sample characteristics were monitored by the principal investigator, and the veteran sample size was judged to be sufficient when data saturation[48] occurred after the 11th interview.

We conducted interviews with 10 VA providers to gain their perspectives on their previous experiences with patients with hearing loss and the use of the PA during the ED encounter. We purposively selected VA providers who were assigned on a regular basis to work in the emergency department (eg, not temporary or on rotation assignment) and provided direct patient care (eg, physicians, nurses, midlevel providers). The purposive sampling plan ensured that selected providers were knowledgeable about the VA emergency department and able to provide perspectives that inform study aim. The provider sample size was determined to be sufficient when data saturation[48] occurred after the 10th interview.

Ethical Considerations

The study was approved by the appropriate institutional review boards (Department of Veteran Affairs NYHHS IRB Committee Expedited Review PROJECT TITLE: [1575047-3] - [HearVA-ED] Hearing Impairment, Strategies and Outcomes in VA Emergency Departments). The informed consent process included a detailed description of all of the study components, an information sheet about the interviews and sufficient time to have questions answered by a research assistant. Veterans and providers gave an informed consent for audiotaping the qualitative interviews. Data were deidentified; audiotapes were destroyed after professional transcription.

Data Collection

Subjects were interviewed individually by a research assistant trained in qualitative interviewing. For the veterans, a semistructured interview guide consisted of a series of open-ended questions (“tell me about your hearing problem” “what did you think of the...”) and probes (“how did you use the …”) that focused the interview while allowing the participant to speak freely and provide information about their use of the device. Qualitative interviews with the providers followed the same format of open-ended questions (“tell me about taking care of patients with a hearing loss in the ED”), with follow-up probes (“what strategies do you use…”; “how have you /your patient used the...”) that focused on their interactions with veterans with hearing loss in the emergency department and barriers and facilitators to assessing hearing loss in the emergency department and the use of a PA with their patients.

Data Analysis

Interviews were audiotaped and transcribed verbatim. Qualitative data were analyzed using directed content analysis[49] and Atlas.ti V8.4 (Scientific Software Development GmbH). Following the analytic steps of Miles and Huberman,[50] transcripts were reviewed line by line and coded. Consistent with directed content analysis, codes were developed a priori based on study aims and the VEHL model; additional codes were added during the analysis.[49] All

analytic decisions, impressions, and the researcher reflections on data collection were recorded. The software's analytic tools including co-occurring codes and networks were used to identify patterns within the qualitative data. Veteran narratives were analyzed first followed by provider narratives. Then patterns were examined across veterans and providers looking for commonalities and differences. The patterns of data yielded key findings that summarized the perspectives and feasibility of the point-of-care PA use in the VA emergency department.

Methodological Rigor

Methodological rigor was assured through an audit trail, regular meetings with experts and member checking, the process by which findings are validated as representative of the experience of the participants.[51] The research assistant recorded reflections after each interview to capture potential influences during data collection.[52] Before coding and analysis, transcriptions were reviewed showing 100% accuracy. The audit trail consisted of methodical memoing of all analytic steps and decision making throughout the study.[51] For example, we tracked the addition of codes with definitions, codes that were merged, and decisions regarding categories and patterns. The audit trail enhanced study credibility.[51]

The research team consisted of experts in nursing, emergency medicine, hearing, and geriatrics; they met biweekly to review findings. During peer debriefing, the audit trail was reviewed, and validation of the conclusions by content experts was achieved. Finally, member checking involved discussing the preliminary findings with clinical and veteran stakeholders to ensure that the findings were representative of their experiences, thereby increasing study credibility and confirmability.[51]

Results Study Participants

The veteran sample (n = 11; mean age 80.3 [SD 10.2)] years) was 45% non-Hispanic White, 27% non-Hispanic Black, and 18% Hispanic White ([Table 1]). This sample reflects the range of variation on key characteristics in the HearVA RCT sample, with the exception that no females were interviewed (in the HearVA RCT, 98.3% of the 133 veterans were male). The providers (n = 10) included 7 nurses and 3 physicians.

Qualitative Findings

A key finding of our analysis is that in the VA ED setting, hearing loss influences patient-provider communication and current approaches are inadequate. Screening for hearing loss in the emergency department was feasible (eg, "it is welcomed!"), except in urgent/emergent cases. Providing the PA was perceived as very beneficial in that it improved the ED experience for veterans and clinicians (e.g., "everyone wins"). Both veterans and providers described frustration in past experiences and challenges to communication and favorable perspectives on the PA use.

One veteran, a Black male in his 80s with known hearing loss described his ED experience and perspective of the hearing assessment and PA use as feasible and beneficial, improving communication and alleviating frustration.I'll ask them could you talk a little louder. Could you write it down? That's what I usually do. Some are very nice, some get impatient, but most understand…it's frustrating…repeat it two and three times…have to raise their voice. I see their frustration…I don't blame them. This time I was here in the emergency department…I really had my mind on other things, but the fact that some of my hearing questions were addressed I felt good about that… and [PA]'s functional…without it I'd feel helpless again….

Similarly, an experienced emergency nurse described a common clinical experience caring for veterans in the emergency department and the feasibility of the point-of-care hearing assessment and PA use:Hearing is one of the vital senses. A lot of patients need to be evaluated…but wouldn't dedicate time…so what usually happens here…we get louder and louder…. Communication is the key! You don't want the patient to misinterpret what you're saying…you want them to hear what you ask and not guess. This [PA] is perfect; we can stay on top of the game. In most cases if the patient can actually hear what you're saying, they can probably understand what you're

asking…trying to convey.

In the paragraphs that follow, we summarize key findings and provide illustrative quotations from veterans and providers in Table 2.

Finding 1: Usual Care Does not Support Effective Communication for Veterans With Hearing Loss

Most veterans knew they had hearing loss, recounted previous hearing tests, and were aware that the VA system offered access to hearing aids. It is noteworthy that even those who had hearing aids reported that they often did not use them in the emergency department for 2 key reasons: (1) fear of losing them within the course of the ED visit and/or hospitalization and (2) diminished effectiveness in the ED setting (eg, owing to background noise). Others said that their hearing aids were not working, were difficult to use/adjust, or, if lost, had simply not been replaced, leaving them with untreated hearing loss. As a result, veterans had difficulty hearing and understanding and felt at a disadvantage navigating their ED encounter and follow-up care.

Providers described the need for and value of identifying veterans with hearing loss. Usual strategies to communicate with veterans with hearing loss in the emergency department included repeating content, talking loudly, using a writing board, and speaking into a stethoscope. These were judged inadequate.

Finding 2: Screening for Hearing Loss in the Emergency Department is Generally Acceptable

Veterans and providers were favorably disposed toward screening for hearing loss in the emergency department. They said that the hearing assessment and brief instruction on PA use did not inhibit/slow workflow or patient evaluation and treatment flow, but rather was an efficient use of “lots of waiting time.” The disclaimer by both groups was that if the emergency department was particularly busy or the patient was seriously ill, hearing assessment was a low priority.

Finding 3: Using the Pa Made Communication More Effective and Less Effortful

Both groups reported that PA use facilitated communication in the emergency department. Veterans noted ease of use, convenience, and quality, and some were eager to use it for other health care visits and beyond the health care setting. Only 2 veterans noted barriers to use; 1 veteran with housing insecurity voiced a safety concern about using the device outside of the health care setting, that is, being seen as having something of value that would make him a crime target. Another noted that although he liked the device, there would always be those who would oppose innovation (“knuckleheads” who “won’t agree with nothing.”) Providers reported that communication was easier because there was less need to raise their voices or repeat questions and instructions. They perceived that veterans seemed to understand better when they used the PA.

Discussion

Many older veterans with undiagnosed or uncorrected hearing loss who present for ED care are at risk of adverse consequences related to poor patient-provider communication in the ED environment.[9,24,25] This study addresses an important knowledge gap in nursing science and emergentology by describing the feasibility of a simple point-of-care intervention that can facilitate communication in ED patient populations with a high prevalence of hearing loss.

The key finding of this study, that hearing loss influences patient-provider communication and current approaches are inadequate, highlights a significant and persistent issue in the care of veterans with hearing loss in the emergency department. The emergency department presents one of the most challenging listening environments in clinical settings.[53,54] Noise levels exceed the level of normal conversational speech, challenging communicative effectiveness even for those with intact hearing.[4] According to Eckert et al,[55] stressful listening situations tend to affect the ability to cope with and communicate in different environments. Research suggests that it is not the severity of hearing loss but self-reported feelings of frustration, embarrassment, irritability, and discomfort when communicating with others that most affect speech understanding ability in the laboratory setting.[56] Furthermore,

individuals with hearing loss have higher odds of rating their satisfaction with communication with their providers as unsatisfactory, are less likely to rate the overall quality of their health care as satisfactory, and may choose to avoid medical visits because they are stressful and frustrating.[57,58]

Findings from this qualitative study complement those from our HearVA pilot study that evaluated the outcomes of objectively measured communication and readmissions to the emergency department. In the quantitative study, we found high receptivity to the intervention (66.2%; n = 133 screen positive patients agreed to participate) and improvements in hearing and understanding among those provided with the PA.[40] This qualitative study describes the subjective experience: both veterans and clinicians were eager to find a way out of the hearing loss status quo of miscommunication and reported that the PA was easy to use and effective. In addition, both groups found screening for hearing loss in the emergency department to work well, with the caveat that it should not be done in emergent settings.

Many of the experiences described here are all too familiar to health care providers who care for patients with hearing loss in the emergency department and have experienced miscommunication, frustration, and failure while providing care.[59-61] What is new is that we provide subjective reports of success and satisfaction with a scalable intervention, albeit within a small and circumscribed sample.

We focused on veterans with hearing loss who received care in the VA emergency department; however, it is worth emphasizing the scope of the population with hearing loss and the magnitude of impact in ED settings. Hearing loss is common among older people; starting at the age of 50 years, the prevalence doubles with every decade and by the age of 70 years, two-thirds of older adults have a clinically significant loss.[2] Adults aged 60 years and older with hearing loss make an estimated 12.09 million ED visits and have 7.39 million acute care hospitalizations every year.[62] Many veterans have dual access benefits and may access VA or non-VA emergency care.[63] Thus, improving communication in ED settings could improve history taking, communication about procedures, adherence, patient education, and understanding of discharge instructions for millions of veterans and nonveterans receiving ED care.

Limitations and Strengths

There are several limitations to this study. The sample was recruited from 1 VA medical center in the Northeast. Although the VA system has similar health care delivery systems and benefits across geographical areas, some care and access to services may vary, and results could differ in different settings. We recruited a racially/ethnically diverse sample; however, we did not have any female veterans in this sample. Efforts to engage female veterans in future research is needed. Veteran perspectives about hearing health care may have been altered by exposure to this intervention, which was provided at no cost and conveniently in the emergency department thus eliminating typical barriers to care. Veterans also potentially benefited by having additional interactions with research staff before these interviews. Perspectives might be different without such exposure. Interviews with our provider sample and the veterans took place during weekday and weekend day shift, so experiences and perspectives may vary at other times. Our decision to limit hours of data collection was in consultation with clinical stakeholders and intended to minimize disruption to patient care. It is also important to note that this study took place before the pandemic. There may now be additional communication challenges associated with face masking and the need to socially distance that were not explored in this study.

Implications for Emergency Clinical Care

The average ED background noise level of 61 to 69 dB challenges communication, even for those with normal hearing.[4] In the noisy ED environment, patients with untreated hearing loss require increased listening effort and demands on their cognitive resources.[9] Our study that included both veteran and provider interviews provides insight into the communication process and challenges that veterans with hearing loss face in the emergency department.

Notably, there was a discrepancy between health care providers' perceptions about hearing assessment in the veteran population and veteran actual experience of hearing assessment. Although health care providers reported that veterans did not know they had a hearing loss, all of the veterans in the study knew they had a hearing loss but many did not have adequate treatment. Our findings from both groups affirmed that existing tactics to address communication between providers and veterans with hearing loss are inadequate. Bridging these gaps is essential to improving care in the emergency department and outcomes after discharge. Emergency nurses are ideally suited to champion innovative strategies to address this patient safety and clinical practice issue for ED patients.

Our findings suggest that a point-of-care hearing assessment and use of a PA may be extremely useful in the VA emergency department. Point-of-care hearing assessment that is integrated with medical intake or history taking may identify undiagnosed or untreated hearing loss that can be addressed using a PA and be followed with referral to an appropriate VA audiology provider. Success with hearing assessment and the assistive device may reinforce the treatment need for veterans. We report that point-of-care use of a PA is an easy-to-use method to facilitate communication between provider and patient. Veterans reported ease, acceptability, and feasibility in the emergency department and across other clinical visits at the VA. Ineffective communication as described by our sample is frustrating and time consuming to both veterans and providers, but veterans may be reluctant to bring or use their hearing aids in the emergency department. Emergency nurses should be aware of potential barriers to hearing aid use in the emergency department that includes fear of losing the devices and diminished effectiveness in the ED environment. Improving communication may lead to better understanding of discharge instructions and potentially lower ED recidivism. Because hearing loss has been associated with health care utilization and social isolation,[64] such interventions have potential to improve quality of life in older veterans.

Hearing loss ranks as a top health compensation and occupation-related disability among veterans[11] and is one of the most prevalent chronic conditions among older adults in general.[2] Accommodations for those with hearing loss are needed to ensure health equity and access to health services.[65] Our results provide a point-of-care accommodation that may be implemented by emergency nurses for those with hearing disability. Given the health disparities associated with hearing loss, facilitating effective patient-provider communication is paramount.

Conclusion

A simple, acceptable device may alter the hearing loss status quo and how patients and providers are able to communicate. Providing the PA improved the ED experience for patients and providers in our study and offers a promising intervention that could improve health care quality and safety for a large patient population.

Author Disclosures

Conflicts of interest: none to report.

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n = 11	Mean	SD
Age, y	80.3	10.2

N = 21	From veterans (n = 11)	From providers (n = 10)
Usual care does not support effective communication for patients with hearing loss.	“Had it tested at the VA…the VA gave me hearing aids…. I don’t bring them… I don’t want to lose them.”Let’s put it this way, I have them [hearing aids]… I’m supposed to use them...with the shouting, banging all here...let’s put it this way…if they are looking at me…and I lean in closely, maybe I can hear some…but there’s a good possibility I wouldn’t hear... I wouldn’t understand.	Communication is the biggest issue…taking a proper history is key. If [veteran] can’t hear and understand what we're saying...that impacts what they tell us….Most don’t know they’re hard of hearing…have to speak loud…it’s almost like [veteran] reads lips to fully understand or write notes back and forth….“Put your stethoscope in the patient’s ears and you speak into the bell…”
Screening for hearing loss in the emergency department is generally acceptable.	“A good use of time….“ “We’re definitely a captive audience…. Lots of waiting.”	“While they wait...that’s a perfect opportunity to just evaluate…be proactive.” “… it helps all of us--the providers and the veterans!”
Using the PA made communication more effective and less effortful.	“It’s simple enough. Just turn it on and it just works… could just adjust it right quick…”This one [the PA] doesn’t pick up everything when I turn it on like the others do with [the PA], I could figure out what the specialist was tellin’ me; [doctor] didn’t have to scream it to me….It’s is easy, very clear sound…makes me comfortable… not strain to listen…. I take it to other doctors….	They don’t ask the same question over and over…. I think it’s because they are hearing me for the first time….It seems to boost their understanding…they are able to answer you, repeat back… they aren’t just guess at what you’re saying....

DETAILS

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Analysis of a Consecutive Retrospective Cohort of Strangulation Victims Evaluated by a Sexual Assault Nurse Examiner Consult Service: JEN

ABSTRACT (ENGLISH)

Objective

The purpose of this study was to review the evaluation of strangulation victims assessed by a sexual assault nurse examiner (SANE) service. The primary objective was to produce observational results on documented injury frequency and secondarily to explore advanced imaging use, outcomes, signs/symptoms, and documentation.

Methods

This was a retrospective analysis of a cohort of 130 consecutive strangled patients over a 42-month period evaluated by a SANE consult service in a metropolitan area. A single investigator extracted medical records for demographics, history, imaging, injuries, disposition, and both presence and documentation of a number of signs/symptoms. A second investigator independently extracted greater than 30% of the total charts with universal agreement. Data were analyzed with descriptive statistics.

Results

Patients were primarily female (129:1) and their age averaged 30.6 years. Time from event to presentation varied. There were no major brain or neck injuries detected (0%; 95 confidence interval, 0-2.31), and all patients were discharged in stable condition. Imaging was used in 23 patients (17.7%). Certain signs and symptoms were more common than others, and documentation frequency of signs and symptoms varied.

Conclusion

In this retrospective cohort of 130 consecutive nonfatally strangled awake patients seen as SANE consults in a single emergency department, there were no major injuries documented. The most common signs or symptoms were neck pain, neck markings, and loss of consciousness. Imaging was used in 17.7% of the patients. Presence or absence of neck pain, neck markings, and altered mental status were most consistently documented. Seizure, subcutaneous emphysema, and carotid bruit were least consistently documented.

FULL TEXT

Contribution to Emergency Nursing Practice

••What is already known on sexual assault nurse examiner assessment of nonfatal strangulation is that the advent of sexual assault nurse examiner care over the last few decades has improved the quality and consistency of the overall care of this vulnerable population. There is some limited research in varied populations on injury patterns and standard ED assessment in this context.

••The main findings of this paper are that no serious brain or vascular injuries were documented, imaging was ordered in a minority of patients, and there was no clear prognostic link with any presenting signs or symptoms and any injuries documented.

••Recommendations for translating the findings of this paper into emergency clinical practice are for emergency departments to recognize that although strangulation injuries can be devastating, major injuries are not commonly documented, advanced imaging should be used selectively, and work needs to be done to improve guidelines on use of both imaging and documentation.

Introduction

Sexual assault nurse examiner (SANE) programs formally began approximately 50 years ago, with multiple hospital systems committing to this process during the mid to late 1970s.[1–4] It was recognized that the standard care for victims of sexual violence could be improved drastically by using specially trained providers and an organized

approach.[5] Over the past several decades, the SANE practice model has been analyzed and refined to make service delivery more efficient for hospitals and patients.[6] SANE encounters are recognized as incredibly valuable to the consulting hospital system, and, more importantly, the quality and trauma-centered expertise are appreciated by the patients themselves.[7] Strangulation events are very common among patients undergoing a SANE evaluation and in patients who have been victims of assault. More than two-thirds of domestic violence victims have been strangled by their partners in their lifetime, and just less than half of domestic violence victims have been strangled in the last year.[8] Although reported strangulation frequency varies, it is common and occurs in as many as one-third of domestic violence patients.[9-11]

Strangulation is compression of the neck, affecting any part of the local anatomy. It is occasionally referred to as choking, but choking is technically obstruction of the lumen of the airway, usually from inside.[12] Injuries can occur with strangulation, although they are not common.[13,14] However, when injuries do occur, they can be devastating. Strangulation is involved in 5.9% of intimate partner–associated homicides,[15] and the rate of homicide by asphyxiation in the United States is in the range of 0.2 per 100,000 women ≥15 years old.[16] The most severe injuries that occur in this context are typically caused by prolonged neck compression leading to brain ischemia, injuries to neck vasculature such as dissections to the carotid or vertebral arteries, or damage to the airway. Reduced cerebral perfusion pressure, either primarily from the neck compression or secondarily from arterial injury, can lead to infarction akin to ischemic strokes that occur commonly outside the context of strangulation. This can be focal or global, depending on the mechanism and pathophysiology induced by the event. Loss of consciousness (LOC) can occur in less than 10 seconds during an effective strangle.[17] Although brief strangulation (events lasting through a few seconds after LOC) rarely results in serious injury,[14] serious injuries including death can occur in as little as 1 to 3 minutes of an effective strangle causing decreased perfusion pressure.[18] Recognition of symptoms and signs of strangulation is vital for emergency clinicians.[19] This is not always easy though. In a large series of domestic violence-related strangulations, Strack et al[20] found that only 50% of women showed any external physical injuries from the strangulation. Of those with injuries, 35% were minor, and just 15% were significant enough for photographic documentation. Even in strangulation homicides, there may be no external physical signs of strangulation.[21] For this reason, to maximize detection and appropriate management, an organized approach to assessment and documentation of strangulation victims is vital. There have been multiple guidelines for the assessment and management of victims of strangulation-related interpersonal violence.[22,23] National organizations have taken a position to help organize the health care community to address the needs involved in caring for this vulnerable population.[24] SANE practitioners can be the front line to evaluate these patients carefully and document in a thorough fashion, and in addition, help address the physical and psychological consequences of intimate partner violence.[25]

The purpose of this study was to conduct a review of strangulation injury assessment in patients being evaluated by a metropolitan area SANE consultation service. These were patients seen by SANE practitioners in the emergency department who reported strangulation as a part of their assault. This study does not include patients not reporting strangulation, nor does it include strangulation in other contexts presenting to the emergency department. The primary objective was to produce observational results to contribute to the existing knowledge of the frequency of discovery of major injury, such as ischemic brain damage, major vascular injury, or airway injury. Secondarily, the goal was to explore use of advanced imaging, outcomes, presenting signs and symptoms, and documentation of those signs and symptoms.

Methods Study Design

This investigation was a retrospective consecutive cohort performed via electronic medical record (EMR) review.

Setting

A review was conducted of every patient who received a SANE evaluation involving reported strangulation over a 42-month period (August 2017 to January 2021). The involved SANE service cares for patients across a large portion of a metropolitan area; however, each of the involved patients happened to be seen in a single large urban level 1 trauma center. This SANE service is involved in the evaluation of reported sexual assault victims after the initial patient evaluation has been completed by the ED care team. The consultation is initiated after the combination of the primary nurse and either physician or physician assistant have agreed that SANE services are needed. This investigation was determined as not considered human subjects research by the HealthPartners/Regions Hospital institutional review board.

Participants

The medical records were identified from a pre-existing approved protected database of SANE consults. Over the analyzed time period, part of standard mandated SANE practitioner case documentation was to record whether or not a strangulation was reported, thus making this a consecutive body of cases to analyze to the extent that this standard database case entry and the reported history were accurate. This documentation also included noting the presence or absence of the signs and symptoms analyzed in this study, although this specific signs and symptoms documentation was not mandated. Cases would have been excluded from this investigation if ED documentation failed to verify the reported strangulation event; however, all cases identified are represented in the presented analysis because this failure did not occur with any case.

Variables

Once cases were identified, the following information was extracted from the electronic health record: age at time of event, sex, race, brief event description, time between event and ED presentation, whether or not advanced imaging was done, type of imaging done, whether or not there was major injury detected (brain injury or vascular injury diagnosed), description of head or neck injury, condition on discharge and then presence or absence of visual symptoms, orofacial petechial hemorrhage, ligature marks or abrasions on neck, neck swelling, neck pain, seizure, unexplained altered mental status, limb numbness, limb weakness, dysphonia or aphonia, subcutaneous emphysema, carotid bruit, incoordination, and LOC. Documentation of the presence or absence of these findings was extracted, and it was also noted whether these findings were not mentioned by the SANE practitioner or the emergency clinician. The last piece of information extracted was whether the patients' current medical problem list included a present or past diagnosis of stroke or cervical artery dissection; if so, further investigation would have been done to try to source the timing of that injury. To help determine the likelihood that the medical problem list had been updated during a follow-up encounter, it was also noted whether or not the patient had contact within the medical system after the investigated strangulation encounter. All extracted data were kept in a secure database within a secure drive.

Data Sources/Measurements

The EMRs served as the primary data source. The date of the SANE encounter was known, and the visit from that date was accessed. Most of the data points were extracted from the documentation of the SANE practitioner and ED provider. Of note, in this particular ED setting, each of the patients was formally evaluated by either an emergency medicine physician or physician assistant along with the SANE practitioner. The documentation from these providers, the nurses, and emergency room technicians all appear in one unified documentation list. The investigators performing the data extraction also searched for radiologic studies associated with the encounter under investigation. In addition, the extractors looked at the main summary page within the record to access the patient's active and past problem list to verify whether or not the injuries mentioned earlier were present.

Bias

One of the main potential sources of error or bias was the chart extraction process. A single investigator extracted each of the charts involved. A second investigator independently extracted multiple random blocks of 10 consecutive charts until they had repeated greater than 30% of the total. If extraction observations varied at all, then formal interobserver agreement analysis was to be done.

Study Size

SANE evaluations were mandated to include the presence or absence of strangulation beginning in August 2017. All patients who were seen by the SANE service and had reported a strangulation between August 2017 and January 2021 were included in this study. The goal of this venture was to present all available data transparently in descriptive fashion as opposed to attempting to reach a particular number of subjects to drive significance.

Quantitative Variables

All variables described earlier were simply counted as a proportion of the entire available dataset of patients.

Statistical Methods

Data are presented in raw form with the addition of proportions of various self-explanatory denominators. The only statistical analysis on the proportions offered is a 95% confidence interval (CI) surrounding the proportion of patients with detected major injury (stroke, vascular injury, neck structural damage). Because none were detected, the zero-event principle was applied, simplifying the 95% CI from a complex proof to [3/n × 100], where n is the total denominator of the group in which the zero events were detected, in this case the full data set of patients. The 3 in the [3/n × 100] can vary depending on context and dataset; however, 3 is most standard in the context of this investigation.[26]

Results

Over the analyzed time period, 130 strangulation cases were identified. All 130 medical records were evaluated for data extraction by a single investigator. A second investigator independently extracted 40 records in 4 random blocks of 10 consecutive charts. There was universal agreement between the 2 investigators. Given this rate of agreement with more than 30% cross-observations completed, the primary rater's extraction was deemed acceptably reliable per convention. No cases were excluded for not having a reported strangulation event.

The average age of the patients was 30.6 years (median, 28.5; standard deviation, 11.1). They were predominantly female (129:1). Self-identified race was White (50.8%), African American (22.3%), mixed (16.2%), Hispanic (5.4%), Asian (3.1%), and Native American (2.3%).

The elapsed time between the assault and the presentation to the emergency department for SANE contact varied greatly: The average was just more than 30 hours. However, the mean is skewed because of some very large gaps in time. The median time was 13 hours, the standard deviation was 42 hours, and 27 of the patients presented within 5 hours of the event.

There were no brain injuries or vascular injuries detected within the analyzed group (n = 130; zero event 95% CI, 0-2.31). There was one patient with an abnormality noted on a computed tomography (CT) angiogram of the neck: a filling defect in an internal jugular vein, reported by the radiologist as potentially consistent with a thrombus. That patient had no other abnormalities on that CT angiogram of the neck nor on the CT head. A follow-up formal ultrasound of the neck during that hospital visit revealed normal flow in all examined neck vessels, including both internal jugular veins. During evaluation by the emergency physicians and the SANE practitioner, the patient had visible abrasions and bruising on the neck with tenderness in those areas but no documented swelling. There were no other abnormal findings documented in the history and examination. This patient was discharged in stable condition and had no follow-up visits or follow-up documentation in the EMR indicating ongoing issues related to the

potential CT findings. In fact, all 130 patients were deemed stable on discharge and none had follow-up visits or diagnoses of brain or neck pathology in their ongoing medical problem list on review of the medical record (which is not inclusive of visits that may have happened or injuries documented outside of the pool of hospitals automatically included in our medical record system). Of the 130 patients included, 89 had visits within the accessible system. Advanced imaging of the head and/or neck was completed in 23 of the 130 patients (17.69%). The imaging performed for those 23 patients is presented in [Table 1]. The presence or absence of signs and symptoms varied greatly, as did the frequency of documentation (see [Table 2]).

Discussion

The primary objective of this exploration was to determine the frequency of serious strangulation-related injury detected in 130 consecutive patients seen by an urban SANE consulting service. There were no ischemic strokes, cervical arterial dissections, cervical spine fractures, airway injuries, or other significant neck injuries noted in this study population. The detected major injury rate of 0% (95% CI, 0-2.31) is similar to previous work using a similar patient population. Matusz et al[13] found major injuries in 0.6% (95% CI, 0.1-2.0) of alert strangulation victims. This distinction is important; the SANE service included in the present study conducts consultations on all patients needing their specialty care. All 130 patients included in this study were awake and alert enough to provide history and participate in the examination. Neck pain and ligature marks/abrasions were the most common presenting symptom and sign, respectively, among these 130 patients. Neck pain as the most common presenting symptom is consistent with previous work.[13] The third most common finding was LOC. LOC was reported in 23 patients, and another 6 were not certain whether or not they lost consciousness. This frequency is comparable with previous literature[13] and is not surprising, given that the LOC can occur in under 10 seconds during a strangulation encounter.[17] LOC has been suggested as an indication for advanced imaging independent of the status of the patient at the time of evaluation.[23] However, in awake and alert patients, transient LOC alone does not necessitate imaging.[13,14] LOC from brief strangulation is akin to LOC from syncope because of a transient alteration in cerebral perfusion.[27,28] Brief LOC from strangulation does not generally lead to poor outcomes,[13,14] and advanced imaging is not likely to be helpful in the absence of other findings. Certainly prolonged strangulation (as little as 1-3 minutes of reduced cerebral perfusion pressure) can lead to anoxic brain injury and death,[18] but in patients with a brief LOC, no neurologic symptoms, and a normal neurologic examination, advanced imaging seems unlikely to add to the evaluation.

The discussion of advanced imaging in the context of strangulation victims needs to be focused on CT angiography (CTA) of the neck. X-ray and ultrasound are not helpful for the most part in diagnosing the injuries of concern; noncontrast CT of the neck does not provide the sensitivity necessary to detect vascular injuries; and magnetic resonance imaging, although very informative, is not universally available. Although cervical vascular injuries are rare, CTA is considered the most appropriate imaging modality for identification.[29] However, some studies[13,29] indicate that the frequency of such injuries is likely greater than previously thought.[30] There are proponents of broad use of imaging in strangulation victims because of the real but small chance of devastating injury and also because of the possibility of occult injuries, which can be missed because of underwhelming signs and symptoms.[23,31] Recommendations such as these, using common signs and symptoms in isolation to drive CTA imaging, are supported mainly by anecdotes. In some studies with collated data on strangulation presentations and subsequent workups, including this study, injuries cannot reliably be predicted by presence or absence of various findings on history and examination.[13,29] There are known risks of CTA imaging, primarily cancer risk from radiation exposure and possibility of allergic reaction to intravenous contrast.[32] In addition, there is the psychological aspect of exposing a recently assaulted patient to a more invasive workup, cost, and a longer stay in the emergency department. This

cannot be discounted in a scenario where the short- and long-term psychological effects are already problematic.[25] Given the above mentioned information, emergency physicians and SANE consultants need to take into account the context of the history and examination to act in accordance with their clinical suspicion to perform the appropriate evaluation. In the 130 patients studied here, 23 had advanced imaging done. The imaging profile shown in Table 1 does not represent workups done solely for strangulation-related injuries. Many of these cases, such as sexual assaults in general, included other forms of trauma as well, including blunt head and neck trauma necessitating head or cervical spine CT.

Documentation in the medical record is an interesting portion of this study's secondary outcomes. Presence or absence of neck pain, ligature marks or abrasions, and altered mental status were more consistently documented than any other findings. The findings most often not documented as being present or absent were seizure, subcutaneous emphysema, and carotid bruit. Of the 130 patients within the analyzed group, there were no significant injuries detected. As such, the lack of documentation of some of the potential strangulation-related signs and symptoms likely represented a lack of clinically significant examination findings that had the potential to change management during the ED course, at least as interpreted by the ED providers and SANE practitioners at the time. This inconsistent documentation represents an opportunity to bolster the approach to assessment and documentation in the future. Complete documentation would include noting the presence or absence of each of the signs and symptoms listed, along with a few others, as important findings in multiple strangulation studies and guidelines including the present work.[13,23,29] This sort of complete documentation could facilitate future research and help identify patients who require advanced imaging and those who can safely forego it.

Limitations

This was a retrospective study as opposed to a prospective data gathering venture. Evaluation of this consecutive series of patients was limited by the information gathered by the providers caring for the patients during each visit, and providers were not asked to retrospectively provide explanation for a lack of documentation of specific examination findings that could have been present in patients reporting strangulation. However, this was part of the goal of the study, in that the presence or absence of documentation itself was an outcome measure.

This group of patients was large enough to contribute to existing literature on the topic, but not large enough to generate significant prognostic patterns of certain findings. In addition, there were no serious physical injuries detected in this patient group, further limiting commentary on predictability of injury based on signs and symptoms. Moreover, signs and symptoms in some cases may have limited utility given the time between the reported strangulation event and the ED presentation.

The 130 patients in this study were awake and alert and could participate in providing history to the providers. Because of this, it should be noted that this study cannot directly inform readers on information on approach to patients who present for care with severe altered mental status or coma. This population is complicated both because of the difficulty of consenting for a full SANE examination during involvement and because of their lack of ability to translate the aforementioned symptoms that might clue providers to do further workup for strangulation-related injuries.

This was a single-center study, and therefore, the local or regional practice standard may have impacted or biased assessment, workup, and documentation.

Follow-up was limited within this patient group, and the follow-up available within the EMR was not robust enough to claim to have identified injuries that might have been missed during the initial visit.

Of note, if this study is used as a platform for prospective data gathering on this topic, the authors would suggest adding headache, memory problems, involuntary loss of bowel or bladder control, and dysphagia to the signs and

symptoms commented on in these current methods and results. These 4 items were not included here, but would be very reasonable to include in future work.

Implications for Emergency Clinical Care

This descriptive study may affect the SANE approach to assessment and management of ED strangulation victims. It reinforces that serious injury is rare and also that documentation for strangulation signs and symptoms can be improved. More research is needed to determine which strangulation patients would benefit from advanced imaging.

Conclusion

In this group of 130 consecutive SANE consults in alert strangulation victims, there were no major brain or vascular injuries detected (0%; 95% CI, 0-2.31). The most common presenting signs or symptoms were neck pain, ligature mark or abrasion, and LOC. Advanced imaging of the brain, neck vasculature, or cervical spine was used in 23 patients (17.69%). Presence or absence of neck pain, ligature marks or abrasions, and altered mental status were the most consistently documented by a combination of the emergency physician or SANE consultant. Presence or absence of seizure, subcutaneous emphysema, and carotid bruit were least consistently documented. Future research is needed to help guide the workup of strangulation victims who are awake and alert in the emergency department given that significant injuries are not commonly documented.

Author Disclosures

Conflicts of interest: none to report.

Type of imaging	Number of patients	% of total imaged
CT head alone	9	39.1
CTA neck alone*	6	26.1
CTA neck, CT head	4	17.4
CT head, CT C spine	1	4.3
CTA neck, CT C spine	1	4.3
CTA neck, CT head, CT C spine	2	8.7

Sign/symptom	Yes	%	No	%	Not documented	%
LOC	29*	22.3	36	27.7	65	50.0
Vision symptoms	2	1.5	66	50.8	62	47.7

Orofacial petechiae	7	5.4	92	70.8	31	23.8
Ligature mark/abrasion	39	30	88	67.7	3	2.3
Neck swelling	2	1.5	62	47.7	66	50.8
Neck pain	63	48.5	66	50.8	1	0.7
Seizure	2	1.5	2	1.5	126	96.9
Unexplained AMS	4	3.1	125	96.2	1	0.7
Limb numbness	2	1.5	57	43.8	71	54.6
Limb weakness	0	0	72	55.4	58	44.6
Dysphonia/aphonia	4	3.1	53	40.8	73	56.2
SC emphysema	0	0	9	6.9	121	93.1
Carotid bruit	0	0	9	6.9	121	93.1
Incoordination	1	0.7	48	36.9	81	62.3

DETAILS

Subject:	Neck pain; Medical records; Emergency medical care; Domestic violence; Documentation; Brain research; Injuries; Hospitals; Emergency services; Emphysema; Sex crimes; Victims; Patients; Symptoms; Victims of crime; Trauma; Consciousness; Sexual assault; Consensus; Strangulation; Murders &murder attempts; Convulsions &seizures; Medical imaging; Stroke
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Recharging Through Advocacy and Support of Legislation: JEN

ABSTRACT (ENGLISH)

The Dr Lorna Breen Act helps to support this effort by having the US Department of Health and Human Services (DHHS) support grants that train health care providers on suicide prevention, other behavioral health issues, and strategies to improve well-being. [...]DHHS would be asked to establish or expand programs to promote mental and behavioral health among health care providers involved with COVID-19 response efforts. The second part of the law states that the DHHS will study and develop policy recommendations on preventing burnout and improving mental

and behavioral health among health care providers, removing barriers to accessing care and treatment, and identifying strategies to promote resiliency.

FULL TEXT

We are nearly halfway through 2022 and continuing to support emergency nurses in so many ways. Springtime for the Emergency Nurses Association (ENA) means our annual day on the hill. This day, and general time of year, means that we are able to go to Washington, DC, to advocate for issues that are relevant to our work and to the patients for whom we care. I sincerely look forward to this opportunity to share ENA's priorities with as many legislators as possible.

If you think about Washington, DC, in spring, you likely can imagine cherry blossoms, the monuments, and the National Mall. Admittedly, on my first-ever visit to our nation's capital, I was surprised to hear that the mall did not have any stores! Turns out, the name for the National Mall is derived from a history of lawn games and grand avenue parks that preceded The Mall in London and consists of a host of incredible museums. There are so many opportunities to take in the history of the United States and to learn about those who have helped to guide and lead our country.

Each year, ENA takes our state and chapter leaders and government affairs chairs to Capitol Hill to support legislation that is relevant to our profession. We have 2 dedicated government-relations experts, Richard Mereu and Rob Kramer, who focus solely on emergency nurses and issues that need attention. These 2 experts led efforts related to the Dr Lorna Breen Health Care Provider Protection Act.[1] This bill was passed in the House of Representatives in 2021, passed by the Senate on February 17, 2022, and signed into law by the President on March 18, 2022.

This law is key to the health and well-being of our care team members. Throughout the year, we have highlighted how emergency nurses should recharge and focus on taking care of themselves to take care of others. The Dr Lorna Breen Act helps to support this effort by having the US Department of Health and Human Services (DHHS) support grants that train health care providers on suicide prevention, other behavioral health issues, and strategies to improve well-being. In addition, DHHS would be asked to establish or expand programs to promote mental and behavioral health among health care providers involved with COVID-19 response efforts. The law recognizes the impact on our care team members and asks for specific efforts to help in ensuring their health. COVID-19 has changed the way we look at health care and the work environments our staff experience.

The second part of the law states that the DHHS will study and develop policy recommendations on preventing burnout and improving mental and behavioral health among health care providers, removing barriers to accessing care and treatment, and identifying strategies to promote resiliency. The passing of this law was key to the acknowledgment of the challenges and marks positive progress in addressing the struggles care team members have seen. ENA was there every step of the way and will continue to be as we find ways to recover, redesign and recharge our nurses.

This action and advocacy is only one of the ways in which ENA supports our members in recharging and engaging in their profession. For many, supporting legislation that improves their work environment is rewarding, and I encourage all ENA members to continue to use their voice and advocate for improvement.

Author Disclosures

Conflicts of interest: none to report.

DETAILS

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Woman With Left Pulsatile Exophthalmos: JEN

ABSTRACT (ENGLISH)

In the disease, there are skin, peripheral and central nervous system, bone, and soft tissue involvements, and there is an increase in the susceptibility to cancer.1 NF-1 is seen once in 3000 births, showing autosomal dominant inheritance and affecting many systems simultaneously.2 The NF-1 gene is located on chromosome 17 and encodes a type of tumor suppressor protein called neurofibromin. [...]of incomplete or incorrect folding of this protein, benign and rarely malignant nerve tumors are seen from the early stages of life. Because the disease affects many systems at the same time, the diagnostic criteria have been shaped in this direction. The magnetic resonance angiography imaging temporal lobe was herniated anteriorly with the median cerebral artery, causing the orbital contents' forward shift (Figure 3). [...]we diagnosed the patient as having NF-1 with sphenoid wing dysplasia.Discussion In NF-1 disease, sphenoid wing dysplasia is seen in 5% to 10% of cases.

FULL TEXT

Background

Neurofibromatosis is rarely seen in emergency departments unless it becomes symptomatic. There are 3 types of neurofibromatosis. Neurofibromatosis type 1 (NF-1; von Recklinghausen disease) is the most common of the 3 types of neurofibromatosis disease. In the disease, there are skin, peripheral and central nervous system, bone, and soft tissue involvements, and there is an increase in the susceptibility to cancer.[1] NF-1 is seen once in 3000 births, showing autosomal dominant inheritance and affecting many systems simultaneously.[2] The NF-1 gene is located on chromosome 17 and encodes a type of tumor suppressor protein called neurofibromin. As a result of incomplete or incorrect folding of this protein, benign and rarely malignant nerve tumors are seen from the early stages of life. Because the disease affects many systems at the same time, the diagnostic criteria have been shaped in this direction. Diagnostic criteria include café au lait spots, neurofibromas, axillary and/or inguinal freckles, optic glioma, Lisch nodules (iris hamartomas), typical bone lesions, and NF-1 disease in first-degree relatives.[3] In uncertain cases, genetic testing may be requested to confirm the diagnosis.

In this case, a rare presentation of NF-1 is discussed.

Case

A 45-year-old-woman admitted to the emergency department with swelling, redness, and pulsation of the left eye for 10 days. She was not complaining of any visual problems or foreign body sensation in her eye, and there was no history of trauma. On physical examination, both pupils were reactive to light, and visual acuity was normal in both eyes. Pulsatile exophthalmos (anterior movement of the eyeball synchronously with the pulse) was observed in the left eye ([Video]). In the detailed physical examination, multiple neurofibromas and diffuse café au lait spots were observed on her skin ([Figure 1]; black arrows for café au lait spots, white arrows for neurofibromas). In the auscultation of the left eye, a systolic murmur was identified. She stated that her father also had the same skin lesions. Brain computed tomography and magnetic resonance angiography were obtained to exclude vascular or other pathologies ([Figures 2] and [3]). Sphenoid wing dysplasia was detected on the bone window of the brain computed tomography ([Figure 2]). The magnetic resonance angiography imaging temporal lobe was herniated anteriorly with the median cerebral artery, causing the orbital contents' forward shift ([Figure 3]). Thus, we diagnosed the patient as having NF-1 with sphenoid wing dysplasia.

Discussion

In NF-1 disease, sphenoid wing dysplasia is seen in 5% to 10% of cases. It is unilateral and mostly asymptomatic.[3] Sphenoid dysplasia is generally paired with ipsilateral temporal arachnoid cyst, which usually blocks the anterior

herniation of the temporal lobe,[4] but in our patient the temporal lobe was herniated anteriorly with the median cerebral artery causing the forward shift of the orbital contents. In this way, pulsatile proptosis and systolic murmur were observed in the left eye's auscultation.

Patient Consent Form

The patient has provided the authors with written consent to publish this work.

Author Disclosures

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Supplementary Data

Video

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2021.12.007.

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A Cross-Sectional Geographic Information Systems Study of a Pediatric Emergency Department Child Restraint System Distribution Program: JEN

ABSTRACT (ENGLISH)

Introduction

A pediatric ED program sought to promote injury prevention through distribution of child restraint systems. Program funds are paid for child passenger safety technician certification of all personnel. Pediatric emergency nurses distributed child restraint systems at hospital discharge and dedicated technicians at fitting stations. Researchers described program characteristics, developed a baseline understanding of program outreach using geographic information systems, and evaluated adherence to manufacturer guidelines with a sensitivity analysis.

Methods

This retrospective cross-sectional study used distribution forms linked to hospital records from 2013 to 2016. Testing for differences used nonparametric methods. Median values and interquartile ranges for weight and height of children were compared with manufacturer guidelines. Geographic information systems visualized recipients' street addresses and motor vehicle crashes on an underlying base map.

Results

There were 312 child restraint systems distributed: of which 179 (57.4%) at the hospital, 126 (40.4%) at fitting stations, and 7 (2.2%) missing a location. Among those on Medicaid, 64.4% received a child restraint system at the hospital compared with 35.6% at fitting stations ($\chi 2 = 5.40$, $P < .02$). Fitting stations had limited outreach to rural residents. Finally, results from the sensitivity analysis showed that devices were issued according to manufacturer guidelines.

Discussion

Despite the workplace pressures of clinical care, pediatric emergency nurses delivered educational information and demonstrated hands-on installation at similar rates to dedicated technicians. Distribution of child restraint systems through the hospital reached a uniquely underserved population. Further research should investigate methods to

improve fitting station outreach among Medicaid recipients.

FULL TEXT

Highlights

••The distribution of child restraint systems offers the opportunity to improve child passenger safety by disseminating knowledge, teaching best practices, and promoting health equity.

••Pediatric emergency nurses distributing child restraint systems through the hospital reached a uniquely underserved population compared with fitting stations.

••Emergency departments and child safety programs should work together when distributing child restraint systems because each serves a heterogenous population.

Introduction

The nonuse or improper installation of child restraint systems (CRS) is associated with high rates of pediatric morbidity and mortality from motor vehicle crashes (MVCs).[1-5] During 2019 in the United States, there were 1053 children aged 14 years and younger who were killed during MVCs.[6] Children were unrestrained in 33% of pediatric MVC deaths.[1]

Studies have demonstrated the pediatric emergency department (PED) is an effective environment to deliver child passenger safety (CPS) interventions among parents and caregivers.[7-11] In a clinical environment, parents and caregivers may be more receptive to behavioral change and knowledge acquisition. Fitting stations, also known as car seat clinics, offer additional opportunities to improve CPS by disseminating knowledge, teaching best practices, and promoting equity in CRS distribution.[7,8,11-14] However, a comparison of the effectiveness of these 2 modalities (PED vs fitting station) reaching children in underserved and rural areas has not yet been evaluated.

A PED-based program presented the opportunity for research into CRS distribution. The PED, the only such unit in New Mexico, was part of a safety-net hospital system that included the sole level 1 trauma center. Program goals were to provide equitable access to CRS, disseminate best practices, and promote injury prevention. Program funds are paid for CPS technician certification of all personnel who distributed CRS, including pediatric emergency nurses and dedicated CPS technicians. Pediatric emergency nurses distributed CRS at the hospital, and CPS technicians distributed CRS at fitting stations.

Hospital Distribution

Pediatric emergency nurses distributed CRS upon patient discharge under 2 circumstances: (1) parents/caregivers had no immediate access to height- and weight-appropriate CRS, or (2) the structural integrity of the device was compromised after a moderate- to high-mechanism MVC. A CRS would infrequently be distributed to a parent in the labor and delivery unit if no properly fitting device was available. In addition, there were several emergency medical technicians and other staff members certified as CPS technicians who distributed units in the hospital.

Fitting Station Distribution

Fitting stations took place on a monthly basis at community sites in Albuquerque, including local fire departments and the PED administration building. Advance notice was given by email, news, word of mouth, and referrals. Individualized appointments lasting approximately 30 minutes were encouraged between fitting station CPS technicians and parents/caregivers to correctly fit the child and demonstrate installation. Instruction manuals and additional educational information were distributed to aid with proper installation. Educational information was delivered by various media including video, brochure, or verbal instruction.

Objectives

The objectives of this study were three-fold: (1) describe the demographics of CRS recipients and program characteristics to examine the effectiveness in reaching underserved populations, (2) develop a baseline understanding of program outreach using geographic information systems (GIS) to advance future efforts, and (3) conduct a sensitivity analysis of the devices that were distributed to evaluate adherence to manufacturer guidelines.

Methods Cross-Sectional Study

A cross-sectional design was used for the descriptive component of the study. Data sources comprised 4 years of distribution forms completed during 2013 to 2016 and data analysis was completed in 2020. Among subjects who received clinical care, forms were linked to hospital medical records via deterministic methods for additional demographic data.

CRS recipients voluntarily answered questions on age, weight, and height of child; street address of residence; and public assistance. Personnel recorded the type of device, location of the distribution (hospital or fitting station), and whether hands-on installation was demonstrated. The study was approved by the University of New Mexico Health Sciences Center Human Protections Office Institutional Review Board, determined to be exempt, and documentation of consent was not required (ID: 17-075).

Continuous data included age in months, weight in kilograms, and height in centimeters. Categorical data included sex of child and whether parents/caregivers resided in metropolitan or rural (comprising small metropolitan, mixed urban/rural and rural) counties,[15] received any type of public assistance or Medicaid, or participated in special supplemental nutrition program for women, infants, and children (WIC). Researchers extracted the type of CRS from distribution forms.

As multiple researchers participated in the data collection process, 10% of chart reviews were reviewed for accuracy of data entry, with findings reviewed with the group over 3 quality improvement sessions. Testing for statistical significance was based on the Mann–Whitney U test for continuous data and the chi-square test for categorical data; the significance threshold was set at the *P* 16

GIS Analysis

A GIS analysis was used to accomplish the secondary objective to develop a baseline understanding of program outreach. New Mexico contains a culturally diverse population residing in a mix of metropolitan, rural, and tribal communities. To advance future injury prevention efforts, MVC data would be displayed on an underlying base map. Geocoding precision was specified to full street addresses, and coordinate data were displayed at the state level, to protect individual privacy. Street addresses would be extracted from CRS distribution forms and, if unavailable or incomplete, then obtained from medical records. To address missing addresses, geoimputation methods were used including the use of the closest post office centroids, public schools, or chapter houses on the Navajo Nation.[17] Out-of-state addresses would not be included in the analysis. Geospatial analysis was conducted using an ArcGIS online base map, imported data points, and New Mexico Department of Transportation MVC data from 2010 to 2014.[18]

Sensitivity Analysis

The tertiary objective was to compare child weight and height data with manufacturer guidelines in a sensitivity analysis. It was prioritized to evaluate the whole program's adherence to guidelines rather than by modality (PED vs fitting station). Although age is a consideration in the decision-making process, weight and height were selected as key covariates for the sensitivity analysis. If data from CRS distribution forms were unavailable or incomplete, then hospital medical records would be accessed. Tables were developed displaying median values and interquartile ranges (IQRs) for the weight and height of CRS recipients. This information was further divided into subgroups based on type of CRS distributed (rear-facing only, convertible, combination, or booster). Evenflo manufacturer

guidelines were researched for device-specific recommended child weight and height ranges.[19]

Results

A total of 312 distribution forms were fully completed; 2 duplicate records were removed before analysis. Distribution forms were linked to medical records for 176 of 179 (98.3%) among those who received a CRS at the hospital. Continuous data were considered to be nonparametric and presented using median and IQR. Age was found to be highly skewed (1.15), whereas weight (0.52) and height (0.66) were moderately skewed.[20]

Characteristics of Recipients and Program

Baseline CRS recipient data are presented in [Table 1]. The median child age (IQR) was 18.0 months (1.0-42.0). The median child weight was 11.3 kg (5.9-15.9) and height 63.5 cm (49.5-91.4). A total of 189 recipients (60.6%) reported receiving some type of public assistance. Among subjects who received a CRS at the hospital, American Indian/Alaska Native (AI/AN) recipients accounted for 41 (22.9%).

The characteristics of the program are presented in [Table 2]. A total of 179 (57.4%) received a CRS at the hospital, and 126 (40.4%) at fitting stations, whereas distribution data on 7 (2.2%) were missing. Educational information was provided to 238 recipients (76.3%), and hands-on demonstrations took place at 145 installations (46.5%). More than 3 quarters of recipients resided in a metropolitan home area population (n = 236, 75.6%). Convertibles were most frequently distributed, accounting for 159 (51.0%), and combination the second most at 65 (20.8%).

The relationship of characteristics between those who received CRS at the hospital and fitting stations is presented in [Table 3]. Among rural residents, 79.7% received a CRS at the hospital compared with 20.3% at fitting stations (χ^2 = 17.56, P 2 = 5.40, P 2 = 1.48, P = .22) or WIC (χ^2 = 0.07, P = .79) utilization between the 2 groups. Finally, no significant differences were noted between educational information provided (χ^2 = 2.33, P = .13) or hands-on demonstrations (χ^2 = 2.54, P = .11) performed at the hospital and fitting stations.

Geographic Distribution

GIS coordinate data were available for 291 (93.3%) CRS recipients. The geocodes of 80 street addresses (27.5%) were imputed. A graduated symbol map, with proportionally increasing circles classified into quantiles, showed a geographically broad distribution ([Figure]). Grouped around the center of the state were 236 CRS recipients (75.6%), where the largest metropolitan center is located, and the other 75 (24.1%) reached rural areas.

Adherence to Guidelines

The relationship between weight/height data and manufacturer guidelines is presented in [Table 4]. Values were not available for each subject despite medical record review; missingness was more pronounced for height (missing = 177) rather than weight (missing = 31). The median weight and IQR of all subjects (n = 271) were within manufacturer guidelines. Available height data (n = 125) indicated that CRS were also within manufacturer guidelines, with the exception of the lower bound of height among booster seat recipients.

Discussion

CRS program data are a rich source of information that is often underused. Our study used a triad of methodology to better use available CRS program data—a cross-sectional design, GIS analysis, and a sensitivity analysis. This study highlighted some of the challenges of conducting research using real-world data such as missingness of covariates. However, this research study presented an opportunity to use data that are often not available from administrative or claims databases.

Previous research has provided insight into those who may benefit most from CRS distribution programs.[12,21,22] Parents/caregivers who indicated they are recipients of some form of public assistance are 1 category. In our study, nearly 61% of subjects self-reported they received public assistance and 53% received Medicaid. Furthermore, our research showed hospital distribution was more effective in reaching Medicaid recipients than fitting stations (64.4%

vs 35.6%; $\chi^2 = 5.40$, *P*

Parents/caregivers who identify as a minority race or ethnic group or speak a primary language other than English have also been shown to benefit from CRS distribution programs.[12,22] Among hospital recipients in our study, we found that more than one-third of children (34.7%) were from a minority race or ethnic group. Furthermore, more than one-fifth of children (22.9%) were AI/AN. Although improvements in CPS have been made on tribal lands, 51% of children aged 12 years and younger were improperly restrained in a study of 6 tribes in the northwestern United States.[23] Efforts to increase the number of CRS distributed among the AI/AN community and educate parents/caregivers on proper use are needed.

Fitting station outreach had a limited impact on the rural population. Among rural residents, only one-fifth (20.3%) received a CRS at a fitting station. There was limited research that compared rural with metropolitan CPS. In a convenience sample of 527 vehicles, 1 study found 28.7% of urban and 41.3% of rural children were improperly restrained in the front seat.[24] Our study is one of the first to examine distribution data with GIS in New Mexico. Ideally, using GIS to map the availability of child safety programs by county would be the next level of analysis.[25]

Mistakes when following recommended guidelines for sizing and installation are common, increasing the risk of morbidity and mortality.[9,21,26-34] Many people find it difficult to install CRS properly, convertible or combination units being especially problematic. Considering that convertibles were most frequently distributed (51%) and the median age of children in our study was 18 (1.0-42.0) months, these findings are pertinent to injury prevention efforts. Convertibles may be used when children outgrow rear-facing specifications and can be later transitioned to forward-facing units. The likelihood of using a poorly fitted device increases with child age, the effect being more pronounced among children who qualify for booster seat use.[27,28,30-32,34] Based on results of the sensitivity analysis, it appeared that CRS recipients were well matched to an appropriate-fitting device; median heights and weights were within device-specific manufacturer guidelines.

Limitations

Data were generated before the development of an a priori hypothesis, and therefore, a retrospective study design was used. Any inferential relationships could have been influenced by bias or confounding. For example, the limited impact that fitting station outreach had on rural residents was strongly influenced by design; fitting stations were localized to the metropolitan area. It would violate assumptions of independence to proceed with advanced data analysis and make further inferences. A significant percentage of missingness was noted among certain covariates, specifically weight, height, and age. These were key variables used for selecting an appropriately fitting CRS. Although results from the sensitivity analysis showed that devices were issued according to manufacturer guidelines, missing data are nevertheless a threat to internal validity in research.

Socioeconomic status (SES) is a dynamic, evolving, and multifactorial definition. Although data from the distribution forms may have served as a proxy for SES, the concept is more complex than self-report of public assistance, Medicaid, WIC, or being from a rural population. As limited as these data are, the distribution forms provided important insight into the SES of those who are participating in a CPS program. The generalizability of demographic data was limited in our study. Data on child race were only available for subjects who received clinical care at the hospital. In addition, Hispanic ethnicity was classified as a race by the hospital, and researchers did not collect language data.

One criterion for CRS distribution was compromised structural integrity after high-mechanism MVC. Pediatric emergency nurses relied on reports of rollovers, extrications, improperly restrained children, and trauma alert protocols according to National Highway Traffic Safety Administration guidelines.[6] The ability of nurses to accurately identify these events was not determined as in other research.[35]

Finally, assumptions in geoimputation could lead to a geographical bias toward larger population centers, and adjustment for population density was not made. However, similar geoimputation methods have been used without serious drawbacks compared with census tracts,[17] and our study was concerned with visualizing crude distribution rates only.

Implications for Emergency Clinical Care

Several benefits were identified that have direct implications for emergency clinical care. Despite the pressures of providing emergency care, pediatric emergency nurses were able to provide educational information ($\chi^2 = 2.33$, $P = .13$) and demonstrate hands-on installation ($\chi^2 = 2.54$, $P = .11$) at similar rates to dedicated CPS technicians. Devices distributed by pediatric emergency nurses in the hospital reached a high proportion of children on Medicaid, demonstrating that the impact of emergency care may extend beyond the reach of fitting stations. Finally, a PED-based program followed manufacturer guidelines when fitting children with appropriately sized CRS.

Conclusions

After the analysis of cross-sectional data from 4 years of distribution forms, pediatric emergency nurses distributed nearly 60% of CRS. The hospital was more effective in reaching Medicaid recipients than fitting stations. Pediatric emergency nurses provided educational information and instruction manuals and demonstrated hands-on installation at similar rates to dedicated CPS technicians. Finally, a sensitivity analysis showed that properly fitted devices were issued according to manufacturer guidelines. Further research should investigate methods to improve fitting station outreach among Medicaid recipients.

Author Disclosures

Conflicts of interest: none to report.

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Variable	Median or n	IQR or %
Child age		
Age in mo (n = 283)	18.0	1.0-42.0
Child weight		
Kg (n = 271)	11.3	5.9-15.9
Child height		
Cm (n = 125)	63.5	49.5-91.4
Child sex		

Female	107	34.3
Male	135	43.3
Missing	70	22.4
Child race*		
White	82	45.8
AI/AN	41	22.9
Other†	21	11.8
Missing	35	19.6
Public assistance		
Yes	189	60.6
No	118	37.8
Missing	5	1.6
Medicaid		
Yes	165	52.9
No	141	45.2
Missing	6	1.9
WIC		
Yes	82	26.3
No	224	71.8
Missing	6	1.9

Variable	n	%

Type of CRS		
Rear-facing only	41	13.1
Convertible	159	51.0
Combination	65	20.8
Booster	37	11.9
Missing	10	3.2
Location of distribution		
Hospital	179	57.4
Fitting station	126	40.4
Missing	7	2.2
Educational information		
Yes	238	76.3
No	46	14.7
Missing	28	9.0
Hands-on demonstration		
Yes	145	46.5
No	138	44.2
Missing	29	9.3
Home area population		
Metropolitan	236	75.6
Rural	75	24.1
Missing	1	0.3

Variable	Hospital (n = 179)		Fitting station (n = 126)		Test statistic	P value
n	Median (IQR) or %	n	Median (IQR) or %	Age		
Age in mo	178	17 (0.0-43.0)	99	18.0 (6.0-41.0)	z = 0.68	.49
Weight						
Kg	165	11.3 (3.7-15.9)	100	12.1 (8.3-16.1)	z = 1.64	.10
Height						
Cm	71	55.9 (48.9-87.0)	54	75.3 (53.3-92.0)	z = 1.86	.06
Sex						
Female	75	72.1	29	27.9	$\chi^2 = 0.83$	.36
Male	102	77.3	30	22.7	Home area population	
Metropolitan	120	52.2	110	47.8	$\chi^2 = 17.56$	< .001*
Rural	59	79.7	15	20.3	Public assistance	
Yes	113	61.4	71	38.6	$\chi^2 = 1.48$	.22
No	63	54.3	53	45.7	Medicaid	
Yes	103	64.4	57	35.6	$\chi^2 = 5.40$	.02*
No	71	51.1	68	48.9	WIC	
Yes	45	57.0	34	43.0	$\chi^2 = 0.07$	.79

No	129	58.6	91	41.4	Educational information	
Yes	144	62.1	88	37.9	$\chi^2 = 2.33$	.13
No	23	50.0	23	50.0	Hands-on demonstration	
Yes	78	55.3	63	44.7	$\chi^2 = 2.54$	.11

Type of CRS	n	Median (IQR)	Manufacturer guidelines[19]
Rear-facing only	41		
Weight (kg)	32	2.4 (2.1-3.9)	1.8-15.9
Height (cm)	24	48.3 (45.7-50.8)	43.2-76.2
Convertible	159		
Weight (kg)	143	9.5 (5.0-12.0)	2.3-29.5
Height (cm)	66	61.0 (50.8-82.2)	48.3-137.2
Combination	65		
Weight (kg)	58	14.8 (13.6-18.0)	10.0-49.9
Height (cm)	21	91.4 (88.9-104.1)	71.1-144.8
Booster	37		
Weight (kg)	30	20.2 (18.1-25.9)	13.6-49.9
Height (cm)	10	113.0 (91.4-134.6)*	101.6-144.8

DETAILS

Subject:	Parents &parenting; Medical records; Population; Stations; Medicaid; Child restraints; Data analysis; Nurses; Emergency services; Outreach programmes; Information systems; Technicians; Pediatrics; Physical restraints; Best practice; Sensitivity analysis; Installation; Certification; Age; Fitting; Injury prevention; Workplaces; Geographic information systems; Children &youth; Rural areas; Caregivers; Injuries; Underserved populations; Clinical nursing; Children; Emergency medical care
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Hypokalemic Cardiac Arrest: Narrative Review of Case Reports and Current State of Science: JEN

ABSTRACT (ENGLISH)

Purpose

Hypokalemic cardiac arrest is an uncommon occurrence in the emergency department. Electrocardiogram findings related to hypokalemic cardiac arrest include prolonged QT, U waves, and preventricular contractions leading to Torsades de Pointes and then arrest. Literature evaluating the prevalence of hypokalemic cardiac arrest is scarce, and its management is lacking. This review provides a summary of current literature, recommendations from current guidelines, and proposed management strategies of hypokalemic cardiac arrest.

Summary

Intravenous potassium administration is the treatment for hypokalemic cardiac arrest. Although the treatment for hypokalemic cardiac arrest is known, there is limited evidence on the proper procedure for administering intravenous potassium appropriately and safely. Owing to the time-sensitive nature of treating hypokalemic cardiac arrest, rapid administration of intravenous potassium (10 mEq/100 mL of potassium chloride over 5 minutes) is warranted. Concerns regarding rapid potassium administration are not without merit; however, a risk-benefit analysis and potential mitigation strategies for unwanted side effects need to be considered if hypokalemic cardiac arrest is to remain a reversible cause. It is imperative to identify hypokalemia as the cause for arrest as soon as possible and administer potassium before systemic acidosis, ischemia, and irreversible cell death.

Conclusions

More evidence is necessary to support treatment recommendations for hypokalemic cardiac arrest; however, it is the authors' opinion that, if identified early during cardiac arrest, intravenous potassium should be administered to treat a reversible cause for cardiac arrest.

FULL TEXT

Contribution to Emergency Nursing Practice

••Current resuscitation guidelines do not provide strong treatment recommendations for the reversible treatment and management of hypokalemia during cardiac arrest with potassium administration.

••This review attempts to show the limited information available to treat hypokalemic cardiac arrest (HOCA), illustrate exacerbating causes, and discuss potential treatment options.

••There is limited evidence to guide the use of intravenous bolus potassium for HOCA.

••Potential treatment solutions for HOCA management are provided that may allow for better outcomes; however, the data for these recommendations are lacking and based on expert opinion.

Introduction

Hypokalemia-induced cardiac arrest is uncommon and can be argued as an underreported occurrence despite the many etiologies that can disrupt potassium homeostasis.[1-3] Noted as being a reversible cause in the American Heart Association (AHA) guidelines for advanced cardiac life support (ACLS), there is currently no guidance from the AHA on how to treat hypokalemia in the setting of cardiac arrest.[2] This lack of guidance was not always the case. In the year 2000, the AHA ACLS guidelines recommended an infusion of 10 mEq of potassium chloride (KCl) at 2 mEq per minute intravenously (IV) over 5 minutes followed by another 10 mEq infusion over 5 to 10 minutes.[1] Unfortunately, there are limited data supporting this recommendation, and the recommendation was later removed in the 2010 AHA ACLS guideline update to state “The effect of bolus administration of potassium for cardiac arrest suspected to be secondary to hypokalemia is unknown and ill advised.” The recommendations since 2010 remain in the updated AHA ACLS guidelines of 2020 with concerns of safety and lack of evidence.[3] In the absence of guidance, the treatment for hypokalemic cardiac arrest (HOCA) remains unclear. In this article, we review influencing factors of ACLS that may exacerbate HOCA, the current evidence for the treatment of HOCA with IV bolus potassium, and potential HOCA treatment strategies.

Methods

The authors followed the Grading of Recommendations Assessment, Development, and Evaluation working group’s methodology to evaluate the evidence.[4] The authors developed a list of questions regarding the use of rapid potassium administration for HOCA. A literature search from PubMed, Ovid, Clinical Key, CINAHL, Cochrane Library, UpToDate, Web of Science, and Google Scholar was performed for articles using the keywords “cardiac arrest,” “intravenous potassium bolus,” “hypokalemia,” “hypokalemic cardiac arrest,” and “severe hypokalemia.” Articles were limited to English language and human studies. No limits were placed on year of publication. Where limited or no data were present, authors acknowledged the lack of evidence and based recommendation on clinical opinion.

Results

Of the 41 articles reviewed, 36 articles were excluded ([Figure]). Five case reports were selected for inclusion. [Table] provides a summary of the 5 case reports.

Discussion Background

The effects of hypokalemia on conduction disturbances are well known to the medical community, involving induced ectopic rhythms in isolated rabbit hearts all the way to identified specific potassium currents during ventricular repolarization in humans.[5,6] Mechanisms of hypokalemia induction are also well known, with the major effectors being diuretic therapy, renin-angiotensin-aldosterone system activation, and cardiac disease (eg, congestive heart failure) resulting in sustained sympathetic activation.[6] Current guidelines characterize hypokalemia as a serum potassium concentration of 7 The threshold at which life-threatening arrythmias occur has been associated with a serum potassium level of less than 2.5 mEq/L, requiring urgent treatment.[7] Although the incidence of HOCA is considered uncommon and limited to case reports, the relative importance of having a treatment modality is essential if hypokalemia in the setting of cardiac arrest is to be considered a reversible cause.[8] To discuss the evidence surrounding HOCA, it would be pertinent to discuss factors of ACLS management that can exacerbate

hypokalemia before discussing and reviewing treatment recommendations.

ACLS Practices Associated with Exacerbating Hypokalemia EPINEPHrine

EPINEPHrine is the mainstay of medication therapy in ACLS; however, its influence on potassium homeostasis may contribute to the overall poor achievement of return of spontaneous circulation (ROSC) seen in cardiac arrest.[2,9] EPINEPHrine works as an alpha and beta agonist. The $beta_2$ receptor agonism may be hindering the positive effects of EPINEPHrine by facilitating an intracellular shift of potassium through the downstream activation of Na^+/K^+ ATPase, ultimately potentiating or worsening HOCA.[10] The relationship between EPINEPHrine and its influence on serum potassium levels was demonstrated in 2 studies. Darbar et al[11] examined the effect of different continuous EPINEPHrine infusion doses on serum potassium levels in healthy subjects. The authors observed a decrease in serum potassium of 0.7 to 1 mEq/L between EPINEPHrine infusion doses of 0.16 and 0.32 mcg/kg/min. Similar findings were identified in patients receiving a fixed dose EPINEPHrine infusion resulting in a decrease of serum K of ~0.8mEq/L with return to baseline after discontinuation.[10] The relevance of these studies showcases EPINEPHrine's effects on serum K^+. However, what remains unknown is the magnitude of K^+ decrease with escalating/repeat doses of EPINEPHrine and whether there is a degree of saturation that occurs where potassium shifting ceases.

The pharmacodynamics of EPINEPHrine observed in the aforementioned studies help to inform ACLS practices in relation to HOCA. Recommended doses of EPINEPHrine during ACLS include 1 mg every 3 to 5 minutes.[2] In a 70 kg patient, 1 mg every 3 minutes equates to a continuous infusion rate of 4.8 mcg/kg/min. In applying the results noted by Darbar et al,[11] EPINEPHrine rates of 0.06 to 0.32 mcg/kg/min demonstrated a 0.7 to 1 mEq/L decrease in potassium, making a case for concern on EPINEPHrine's influence on potentiating or worsening HOCA. It is important to address the fact that the studies previously mentioned were done in healthy subjects, which cannot be directly translated to patients who are critically ill or experiencing cardiac arrest.

Sodium Bicarbonate

Recommendations on sodium bicarbonate administration have been limited to special resuscitation situations when sodium channel blockade or hyperkalemia is suspected; however, despite these recommendations and the lack of benefit of its routine use outside of said indications, sodium bicarbonate continues to be used in patients with cardiac arrest.[2,12] The routine use of sodium bicarbonate outside of the recommended indications of ACLS management is important to address based on its potential to exacerbate HOCA.

The influence of sodium bicarbonate administration in HOCA entails its immediate effects on potassium shifts related to metabolic acidosis. During acidemia, a net shift of K+ from the intracellular to the extracellular space occurs.[13] If the acidosis is treated with sodium bicarbonate, there is a reverse shift of potassium back into the cells.[14] Multiple studies have looked at sodium bicarbonate administration in hyperkalemia with conflicting results; however, a potential decrease of serum potassium up to 0.5 mEq/L has been reported.[14–18] Based on these mechanisms, sodium bicarbonate could potentiate or even worsen HOCA.

Dextrose

Dextrose is often given for hypoglycemia and/or undifferentiated encephalopathy; however, with administration of dextrose, there is insulin release that may cause a shift of extracellular potassium intracellularly that can also worsen underlying hypokalemia.[19]

Treatment of Hypokalemia

The gold standard of hypokalemia treatment is to replace potassium. Understanding the infusion limits on potassium will help explain the reluctance to exceed these rate limits in the treatment of HOCA. Kruse et al[20] provide a basis for potassium infusion limits in healthy individuals. In their study, 20 mEq of KCl was infused IV over 60 minutes and

demonstrated saturation of potassium homeostasis mechanisms resulting in an abrupt increase in serum potassium of ~0.4 mEq/L from baseline.[20] After infusion completion, serum potassium rapidly redistributed, resulting in an expected 0.2 mEq/L increase of serum K+ from baseline from a 20 mEq/100 mL infusion.[20] Owing to the risk of hyperkalemia leading to dysrhythmias and sudden cardiac death, potassium infusions are not generally administered faster than 20 mEq/hour; however, safety for infusions up to 40 mEq/hour has been demonstrated.[9,20-22]

Osmolarity may become a concern when choosing between IV KCl solutions to administer. The osmolarity of concentrated KCl (2 mEq/mL) is 4000 mOsm/L whereas premixed KCl 10 mEq/100 mL is 200 mOsm/L. Given the high osmolarity in concentrated KCl, administration of KCl 10 mEq/100 mL would be the most ideal and matches with Institute for Safe Medication Practices (ISMP) recommendations to use KCl premixes in place of concentrated potassium vials.

These limitations bring conflict to the decision on how to treat patients with HOCA owing to the urgent need for rapid potassium replacement in a short time period.

ACLS Guideline Recommendations

ACLS guidelines in the year 2000 had recommended a rapid potassium infusion for the treatment of cardiac arrest or malignant ventricular arrythmias owing to life-threatening hypokalemia.[1] The infusion of KCl was dosed at 2 mEq per minute IV for a total of 10 mEq followed by another 10 mEq infusion if needed until patient is stable.[1] Unfortunately, there were no documented references on which to base this recommendation. Alfonzo et al[23] recommended a similar treatment route with life-threatening hypokalemia, administering 20 mEq of KCl over 10 minutes. In the case of cardiac arrest, Alfonzo et al[23] recommended 20 mEq of KCl IV over 2 to 3 minutes. These recommendations also lacked referenced data to support them.

In 2010, the AHA updated the ACLS guidelines to indicate the effect of IV bolus potassium for cardiac arrest was unknown and administration was ill advised. Updated recommendations in 2020 go further to suggest that IV bolus potassium is not recommended.[2,3] It is unclear what evidence AHA used to indicate administration of IV bolus potassium is ill advised because the references provided do not address this comment. Evidence used for the 2020 ACLS recommendations regarding HOCA is not comprehensive, listing 1 study consisting of 2 case reports. The first patient's serum potassium was "between 2.8 and 3.5 mEq/L," and the use of quiNIDine resulted in the ventricular arrythmia. The second patient had a complicated cardiac history making it difficult to assume that a mild to moderate potassium correction was the key driver for patient stability.[24]

The new European Resuscitation Council Guidelines of 2021 mimic the recommendations from the ACLS 2000 guidelines, without supporting evidence for this recommendation.

Review of Rapid Potassium Administration

Question: Among patients with HOCA, does rapid administration of IV KCl improve survival?

Ungraded Statement: There are insufficient data to conclude rapid administration of IV KCl improves survival.

Rationale: Five case reports describe the rapid administration of IV KCl for HOCA. In the 5 case reports, administration of KCl led to the achievement of ROSC. The case reports are further detailed below.

The first case report by Bannister et al[25] in 1977 was in a patient who was diagnosed as having hypokalemia with a serum potassium of 1.3 mEq/L. Immediately after diagnosis, the patient developed ventricular fibrillation. Patient was successfully treated with external cardiac massage and a 60 mEq/100 mL bolus of KCl IV over 5 minutes.

The second case report by Tassone et al[26] in 2004 was in a patient who had developed asystole secondary to unknown thyrotoxicosis. A potassium level was drawn bedside revealing a serum K level of 1.5 mEq/L. During ACLS, the patient was given 40 mEq of KCl over 30 minutes. ROSC was achieved. Despite the initial intervention,

additional doses of KCl had to be given until the discovery of an underlying thyroid issue.

The third report of rapid potassium administration for HOCA comes from Abdulaziz et al[27] in 2012 in a patient with diabetic ketoacidosis before cardiac arrest. An immediate potassium level was drawn showing 1.7 mEq/L. A 40 mEq KCl IV bolus was administered resulting in immediate reversal of asystole and achievement of ROSC. KCl administration rate was not documented.

The fourth report from Martindale et al[28] in 2020 involves a dialysis patient brought in by emergency medical services in cardiac arrest. A venous blood gas drawn before the administration of insulin, dextrose, sodium bicarbonate, and calcium chloride for presumed hyperkalemia was reported revealing a potassium level of 2.3 mEq/L. A KCl bolus of 40 mEq over several minutes (administration time not clarified) obtained ROSC with a following serum potassium level obtained after ROSC of 3.3 mEq/L. Patient experienced an additional 2 ventricular fibrillation arrests where ROSC was achieved after bolus administration of 20 mEq of KCl. Patient died 16 hours later from another ventricular fibrillation arrest.

The fifth report comes from Liu et al[29] and involves a 21-year-old patient in ventricular tachycardia. Potassium level was 1.5 mEq/L, and after 20 minutes of standard ACLS protocol, a 40 mEq/40 mL KCl bolus was administered via central line, rate not documented. Within 8 minutes of the KCl bolus, ROSC was achieved. A repeat potassium level of 2.1 mEq/L was seen after ROSC.

Some limitations of the previously listed case reports include data on infusion rates, possibility of other therapies being the primary cause of ROSC, and positive publication bias.

Question: Among patients with HOCA, does rapid administration of IV KCl cause harm?

Ungraded Statement: There is currently no evidence to conclude that rapid administration of IV KCl in patients with HOCA causes harm.

Rationale: No trials have been reported that indicate the rapid administration of IV KCl in patients with HOCA causes harm. It is important to recognize IV potassium as a high-alert medication as identified by ISMP. ISMP has published reports of serious errors with the use of concentrated KCl vials outside of a cardiac arrest setting.[30]

Question: Among patients with HOCA, what dose of KCl should be used for rapid administration of IV KCl and at what administration rate?

Ungraded Statement: There is an insufficient amount of high-quality data to determine a dose or rate of administration of IV KCl for patients with HOCA.

Rationale: Of the 5 case reports previously mentioned ([Table 1]), KCl dosing strategies were inconsistent and ranged from 20 mEq to 60 mEq over 0 to 30 minutes IV.[25-29] Extrapolating from studies in patients not experiencing HOCA, max infusion rates of KCl can be given up to 10 mEq over 15 minutes.[9,21,22] There are no studies comparing dosing strategies for IV potassium administration in HOCA; however, rapid replacement is warranted. One study by McCall et al[31] examines the rise of serum potassium levels through continuous blood sampling in cardiopulmonary bypass patients after IV push of KCl. In this study, patients were given an average of 3 mEq of KCl IV push, which demonstrated a rise in serum potassium levels of ~3.1 mEq/L at ~17.5 seconds. The serum potassium levels returned to baseline in ~68 seconds. A rise in serum potassium level of 3 mEq/L in a patient presenting with HOCA may be appropriate to obtain ROSC; however, this cannot be concluded from this study. Comparing these results with the recommendations from the 2000 AHA ACLS guidelines, the 2021 European Resuscitation Council Guidelines, and Alfonzo et al,[23] it may be appropriate to consider a rapid KCl infusion of 10 mEq/5 minutes to achieve serum potassium levels that would increase the chance of achieving ROSC. Unfortunately, the data from McCall et al[31] cannot be extrapolated to patients experiencing HOCA given that there are multiple factors effecting potassium homeostasis described in this review that are not present in the studied population by McCall et al.[31]

The authors conclude that mimicking the dosing strategies from the 2000 AHA ACLS guidelines, the 2021 European Resuscitation Council Guidelines, and Alfonzo et al[23] is preferred to no treatment at all for HOCA. The authors also emphasize caution that a KCl bolus is intended only in the cardiac arrest setting and not to be used once ROSC is achieved. To avoid potential serious drug errors in relation to using concentrated KCl vials, ISMP safe practice recommendations include using premix KCl solutions of which can be stocked and readily available throughout the hospital. The authors echo these safe practice recommendations and to use KCl premixes via rapid infusion in the setting of HOCA.

Role of Calcium

Calcium has a few postulated mechanisms of actions for the management of hyperkalemia. The mechanisms proposed include calcium's action through calcium-dependent cellular depolarization and propagation, restoration of resting membrane potential, shifting of Vmax resulting in the restoration of normal myocyte excitability, and, finally, reversing myocyte depression by increasing the magnitude of the calcium inward current.[32,33] All of these effects are proposed through having a higher calcium concentration in the bloodstream through the administration of calcium. The evidence for calcium's use in hyperkalemia is weak but its use for preventing arrythmias and cardiac arrest is widely accepted.[20,34] Because of these mechanisms, pretreatment with calcium can be theorized to prevent the negative cardiac effects associated with IV bolus potassium, thereby limiting the associated danger of its use in ACLS.[35]

Calcium is not without its risks. By its same mechanisms involved with treating hyperkalemia, there is a possibility to cause a ventricular tachyarrhythmia resulting from the enhanced automaticity, but the evidence supporting this information is weak. Although, traditionally, calcium has been contraindicated with the patient's concurrent use of digoxin, there is no strong supporting evidence, and it is the opinion of the authors that it should not preclude the administration of calcium.

Role of Magnesium

Magnesium is a known component of any hypokalemia treatment protocol. The role of magnesium is to inhibit the renal outer medullary potassium channels in the distal nephron preventing the loss of potassium.[36,37] If there is a magnesium deficiency, potassium will be lost more readily through the renal outer medullary potassium channels, impairing any effort at potassium replacement.[37] Its effects in HOCA are limited; however, it may be good practice to administer magnesium in HOCA to prevent potential potassium losses if ROSC is achieved. This is particularly important especially because the most common arrhythmias associated with hypokalemia are ventricular fibrillation and Torsades de Pointes.

Other Treatment Options

Alternatives to IV bolus potassium would include extracorporeal membrane oxygenation; however, given the limited availability of extracorporeal membrane oxygenation access to most hospitals, it will not be reviewed here.

Hypokalemia Management in Cardiac Arrest

Based on the evidence available, there are limited data to determine how to administer potassium for HOCA; however, it is the authors' opinion that it is reasonable to treat confirmed HOCA by administering KCl 10 mEq/100 mL premix over 5 minutes given that the potential benefits outweigh the risks. The European Resuscitation Council Guidelines of 2021 make recommendations similar to those of Alfonso et al,[23] with a rapid infusion of potassium of 2 mEq/min for 10 minutes followed by 10 mEq over 5 to 10 minutes. Regardless of the method, potassium replacement should take precedence over other pharmacologic interventions. Noting the evidence to support this recommendation is poor, based on case reports, rapid potassium administration makes the most rational sense in a time-sensitive situation such as HOCA until further studies define a more appropriate method.

This recommendation is only intended in the clinical situation of HOCA. It is recommended to use the KCl premixes if available to prevent medical errors identified through ISMP with the use of concentrated KCl vials. Documentation of KCl administration should be considered as stated in the 2000 AHA ACLS guidelines: “In the patient’s chart, document that rapid infusion is intentional in response to life-threatening hypokalemia.”

Conclusion

There is limited evidence and significant positive publication bias guiding the treatment of HOCA. Potassium replacement for a cardiac arrest induced by a potassium deficit is the solution; however, how that deficit is corrected is not well defined. It is imperative that well-designed prospective trials of HOCA treatment involving potassium replacement dose, rate, and potential detriments of therapy be conducted to further guide appropriate management. In the absence of these data, we recommend using the aforementioned strategy. It is reasonable to believe that HOCA is rare, because acidosis caused by arrest leads to hyperkalemia. However, in-hospital cardiac arrests where more information is often available, such as the patient’s most recent laboratory reports or medications administered, can lead to scenarios where hypokalemia can be identified as the reversible cause of cardiac arrest and subsequently treated. Thus, it is the opinion of these authors that, if identified, potassium should be administered for HOCA.

Author Disclosures

Conflicts of interest: none to report.

Reference	Age in y (sex)	K+ level (mEq/L)	Developing rhythm	Potassium intervention	Outcome
Bannister et al[25]	58 (female)	1.3	V-fib	60 mEq KCl IV over 5 min	ROSC
Tassone et al[26]	22 (male)	1.5	Asystole	40 mEq KCl IV over 30 min	ROSC
Abdulaziz et al[27]	23 (female)	1.7	V-tach	40 mEq bolus, unknown bolus rate	ROSC
Martindale et al[28]	52 (male)	2.3	V-fib	40 mEq bolus, unknown bolus rate	ROSC
Liu et al[29]	21 (male)	1.5	V-tach	40 mEq bolus, unknown bolus rate	ROSC

DETAILS

Subject:	Patients; Homeostasis; Hypokalemia; Arrests; Acidosis; Sodium; Side effects; Emergency services; Myocardial infarction; Potassium; Hyperkalemia; Mitigation; Reversible; Management; Emergency medical care; Heart attacks; Necrosis; Ischemia
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NCPD Earn Up to X.X Contact Hours: JEN

FULL TEXT

TVM:UNDEFINED

DETAILS

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Patient Extrication Process for Urban Emergency Departments: JEN

ABSTRACT (ENGLISH)

Objectives

This project aimed to create and implement a safe and efficient role-based process to rapidly extricate traumatically injured persons transported to the emergency department via police transport or private vehicle.

Methods

A simulation exercise was conducted with an interdisciplinary team of ED personnel, Philadelphia Police Department, and University of Pennsylvania police officers to identify the necessary steps to rapidly extricate traumatically injured individuals.

Results

The simulation exercise identified several new processes needed to complete rapid extrications of traumatically injured individuals from private and police vehicles. These included a safe drop-off location, ED personnel role identification, proper personal protective equipment donning, 2 rapid extrication techniques, and a hard stop for weapon check by security before entering the emergency department.

Conclusions

Through simulation, the ED interdisciplinary team was able to develop a role-based safe and efficient rapid extrication process. Educating new ED personnel, security, and Pennsylvania police continues to facilitate ongoing safe rapid extrication practices in the emergency department.

FULL TEXT

Introduction Rationale

Similar to many urban areas in the United States, Philadelphia has experienced a substantial increase in gun violence over the last year (Figure 1).[1] Gun violence is a public health crisis, particularly in the Philadelphia region.[2-4] Unlike other urban areas, officers from the Philadelphia Police Department (PPD) transport shooting victims from the incident scene to the nearest trauma center, a process known as scoop and run. Approximately one-quarter of shooting victims in Philadelphia are cared for at Penn Presbyterian Medical Center, a level 1 trauma center located in West Philadelphia (Figure 1).[5] The PPD policy directing officers to transport “persons suffering from serious penetrating wounds”[5] was initiated in 1996 in the hopes of decreasing time to emergency care and saving more lives. This policy has resulted in a considerable rise in the number of people transported directly to the emergency department via police or private vehicles (PVs) (Figure 2).[6] There is some evidence that shooting victims arriving via PV have a lower mortality rate than shooting victims transported by Emergency Medical Services (EMS).[7-9] In 1 meta-analysis, 74,187 patients with gunshot wounds (GSWs) were treated at 182 trauma centers.[7] The majority (76%) were transported by EMS whereas 12.6% were transported by PV. By individual trauma center, the proportion of patients transported by each category varied widely: EMS (median, 78%; interquartile range [IQR], 66%-85%), PV

(median, 11%; IQR, 7%-17%), or others (median, 7%; IQR, 2%-18%).[7] Unadjusted mortality was significantly different between PV and EMS (2.1% vs 9.7%; *P* 7 Multivariable analysis demonstrated that EMS-transported patients had a greater than twofold odds of dying than PV (odds ratio, 2.0; 95% confidence interval, 1.73-2.35).[7] In addition, another study evaluated mortality rates of PV transport that included police transport and found that PV transport was associated with a significantly lower likelihood of death than ground EMS transport for individuals with GSWs and stab wounds in urban US trauma systems.[8]

Once dispatched, it takes an average of 9 minutes for EMS to arrive on the scene.[10] With the scoop and run process, the PPD officers immediately place the injured person in the rear of the police vehicle and travel with lights and sirens to the nearest trauma center.[6] While en route, the officer communicates with the PPD dispatchers who then call the emergency department to inform them of the incoming penetrating trauma patient, more often than not a gunshot victim. Depending on the proximity of the incident to the hospital, there may be little, if any, prenotification to ED staff.

During rapid transport to the trauma center, the injured person is not secured and often ends up in the confined space of the vehicle's floor up against the partition dividing the front and back seat.[9] This creates a challenge when trying to rapidly extricate the person from the floor of the vehicle. Although there is some information about rapid extrication of persons from a vehicle at the scene of an accident,[11,12] to the best of our knowledge, there is no existing standard of practice for rapidly extricating traumatically injured persons from police vehicles or PVs upon arrival to the emergency department.

Seconds count in caring for the gravely injured; processes of care for victims of trauma are improved with strong leadership and teamwork.[13] Clinicians and police identified the need for a systematic, role-based approach to extricate persons from police vehicles. The goal in creating a role-based rapid extrication process was to eliminate confusion and improve safety and efficiency in getting the injured person to the treatment area. This article aimed to use the Template for Intervention Description and Replication framework[14] to describe the creation of a safe and efficient process to rapidly extricate traumatically injured persons transported to the emergency department via police transport or PV (see [Table]).

Who

An interdisciplinary team of ED personnel including nurses, ED technicians, hospital security, University of Pennsylvania police officers, and Philadelphia police officers participated in an exercise designed to simulate the existing process for rapidly extricating patients from a police car. ED leadership provided staff with space, time, and encouragement to perform the exercise. ED personnel with prehospital backgrounds were able to share their knowledge of various lifting and extricating techniques used in the field.

Where

The simulation exercise was conducted in the driveway and entrance of the emergency department at Penn Presbyterian Medical Center, an urban academic medical center with level 1 trauma designation.

What

The University of Pennsylvania Police Department provided multiple police vehicles including sedans of various sizes, sports utility vehicles, and vans, for which different scenarios and challenging patient presentations were simulated using participating clinicians. The use of multiple vehicles helped to generalize the approach and increase applicability to other emergency departments. This enabled the interdisciplinary team to collaboratively run through the current process and discuss, alter, and experiment with different rapid extrication techniques. We also reviewed the evidence on safely and efficiently extricating patients from vehicles. In a meta-analysis of 24 studies of spine immobilization in penetrating traumas,[15] none of the studies found benefit to spine immobilization in regard to mortality and neurologic injury.[15] In fact, there was an increased risk or mortality associated with spine immobilization with a risk ratio of 2.4 (confidence interval, 1.07-5.41).[15] Therefore, spine immobilization was not included as part of our extrication process.

After completion of this initial simulation exercise, the leadership team was able to (1) identify the appropriate drop-off location for police vehicles and PVs, (2) delineate the roles ED personnel perform during the rapid extrication

process, (3) determine the proper personal protective equipment (PPE) donning location and PPE equipment needed, (4) identify and refine 2 safe and efficient rapid extrication techniques, and (5) mandate a security hard stop for weapon checks in the vestibule before the individual's entering of the trauma bay.

Drop-Off Zone

During the simulation exercise, police and clinicians identified a need for visual cues to direct arriving officers where to stop in the ED driveway. Visual cues are now provided via a “drop-off lane” that includes a large sign “Police Emergency Drop-off Here” in tall, visible red letters. It sits on the sidewalk next to a solid yellow line with the words “Police Drop-off” painted on the driveway, positioned approximately 1 car length past the ambulance bay doors and on a relatively flat surface. This positioning allows space behind the vehicle to maneuver patient stretchers (Figure 3). PVs use the same drop-off location to get as close to the door as possible on a flat surface.

PPE

The ED ambulance entrance was redesigned to facilitate quick access to PPE and supplies. Three stretchers with backboards for lifting are kept in the ambulance entrance as well as the appropriate PPE for staff to don before proceeding to the vehicles for extrication. The standard rapid extrication PPE consists of impervious gowns, bouffant caps, gloves, eye protection, and face masks (Figure 4). As team members are donning their PPE, each verbally declares their role, based on the time of clinician arrival and experience.

Role Identification

Rapid extrication can be performed with as little as 2 clinicians but for optimal safety 3 clinicians per injured person is ideal. The main nurses station where the charge nurse is stationed and 2 additional nursing zones are directly across from the ambulance bay doors. The ED attending physicians and residents are stationed directly next to the ambulance bay doors facilitating a rapid response from nurses, ED technicians, and physicians. We have trained all staff in the following 3 roles.

Team member #1 is the primary team leader during extrications, responsible for deciding which technique to use based on the vehicle and presentation of the injured person. When the vehicle comes to a complete stop, team member #1 opens the nearest side door and makes contact with the injured person. This person is typically a nurse who does a rapid assessment of whether the patient is responsive and how capable the patient is to assist with the extrication. If the person is alert and able to ambulate, the team member will assist them to the waiting stretcher. If the patient is unresponsive or unable to ambulate, team member #1 identifies to the rest of the team the location of the injured person’s head. Simulation training identified that it is easier to remove the injured person head first to the awaiting stretcher. Therefore, it is essential to know which side of the car the injured person’s head is closest to to facilitate a safe and efficient extrication to the waiting stretcher. Once on the stretcher and moving toward the vestibule, the nurse looks for hemorrhaging wounds that require direct pressure and conducts basic airway, breathing, and circulation assessments. The nurse will also ask an alert patient if they have ever been shot before and how many gunshots they heard. This information provides the trauma team with an approximation of how many bullets to look for and/or determine whether there are bullets retained from previous shootings. During transport, the nurse informs the patient of what to expect once they arrive in the trauma bay.

Team members #2 and #3 are responsible for maneuvering the stretcher and placing the backboard at the correct location after team member #1 identifies which side of the vehicle the patient’s head is presenting. Team member #3 will remain at the head of the stretcher to ensure it does not move and to lock and unlock the stretcher during the rapid extrication. These 2 techniques were identified using the emergency medical technician rapid extrication guidelines[11] and previous emergency medical technician experience of several of our nurses and ED technicians.

Two Rapid Extrication Techniques The Bridge Technique

The most commonly used technique is the “bridge” technique, in which the person is lifted from the car seat to the stretcher by team members #1 and #2. This approach can be made easier by bridging the gap between the stretcher and car seat with a rigid EMS backboard that acts as a slide board to support the person while extricating (Figure 5). This technique works best for smaller persons who are easily lifted and moved. Another consideration for this technique is how wide the vehicle door opens to maneuver the stretcher close enough to the vehicle seat and at the

height of the vehicle in relation to the stretcher. The bridge technique works well for sport utility and van vehicle types.

The Ground Technique

The second technique used is the “ground” technique. This technique is used for larger persons that may be too difficult for team members #1 and #2 to lift up onto the stretcher. This technique is also useful when the vehicle door does not open wide enough to allow the stretcher near the car or when the vehicle seat is lower than the stretcher as seen in sedans and low-riding vehicles. When the ground technique is called for, the backboard will be placed on the ground perpendicular to the vehicle. Team member #3 will position the stretcher so the foot of the stretcher lines up linearly with the backboard. Team member #3 will then lock the stretcher and position themselves so that they can secure the backboard from moving while team members #1 and #2 slide the person from the vehicle onto the backboard, while supporting person’s head and neck. Once the person is fully on the backboard, all team members will lift the backboard up and onto the stretcher (see Figure 6). Team member #3 will then unlock the stretcher and move the person into the ED vestibule.

Weapons Screening

After the person is extricated from the vehicle and placed onto the stretcher, they are brought inside the ED vestibule area in the ambulance entrance area. Regardless of the person’s clinical condition, once in the vestibule, the stretcher is stopped and appropriate security staff members perform a pat-down of the person. This “Hard Stop” is performed on all injured persons and lasts on average 10 seconds with the sole purpose of removing and securing any obvious weapons before the injured person enters fully into the emergency department. Owing to the construction of stretchers, metal detecting wands are ineffective in distinguishing a concealed weapon from artifact. Therefore, it is essential that security conducts manual pat-down for detection and removal of weapons in the vestibule before the person entering the trauma bay. Through the collaboration and work with Penn Presbyterian Medical Center security and University of Pennsylvania Police Department, the “Hard Stop” and weapons screening has become the expected and routine procedure. Figure 7 is part of a poster hanging in the vestibule area of our ambulance entrance, as an additional visual aid for our security personnel.

Training

The initial simulation was an active learning exercise to identify safe and efficient methods to extricate traumatically injured patients from police vehicles or PVs. The knowledge and understanding that were gained from the simulation were then translated into a formal extrication procedure that clearly outlined roles and responsibilities for each discipline. Before the implementation of the process, ED technician and nursing champions were identified. This core team, along with nursing leadership, mentor and advise staff during rapid extrications. Real-time orientation to the process is supplemented with didactic educational sessions and slide presentations. Education on the process begins at orientation for all new ED and security staff.

Who

Education for ED clinicians and security staff was developed by the clinical nurse specialist (CNS) and an ED staff nurse with previous prehospital experience.

What

The rapid extrication process has been outlined in a step-by-step fashion in a PowerPoint document (Supplementary Appendix) that has been distributed to ED clinicians and security staff. Another educational tool used is the algorithm shown in Figure 8, which delineates the steps for using the ground and bridge techniques. This information has also been distributed through verbal discussions to ED clinicians at morning change of shift huddles.

How Often

The extrication process is included in the new employee orientation binder for nurses, physicians, and ED technicians. In addition, owing to turnover and increasing trauma volume, education of ED and security personnel on this process is ongoing to ensure that there is no gap in using this safe and efficient standardized rapid extrication approach. ED clinicians are provided the opportunity to practice extrication in a controlled environment during annual competency updates. Staff also provide feedback in real time with each extrication of a patient from a police vehicle

or PV to the charge nurse who then relays the feedback to the ED CNS. If necessary, the ED CNS provides individualized education to clinicians.

How Well

We timed the interval from arrival of the vehicle to patient arriving in the vestibule for the hard stop for 27 victims using the security videos. The average time it took to rapidly extricate the victim from the car to the ED vestibule before the simulation was 60.33 seconds. With implementation of the role-based extrication process, the average time to extrication decreased to 51.5 seconds. Although an 8- to 9-second decrease may seem small, every second counts when treating people with GSWs. Often, patients survive the gunshot but hemorrhage before reaching the hospital.[16] Efficiencies realized through the development of the role-based extrication process improved time to patient arrival in the trauma bay for definitive treatment.

Implications for Emergency Nursing

This article aimed to offer guidance on the development and implementation of a role-based extrication process in the instance that other municipality police departments decide to adopt a scoop and run policy for transporting gunshot victims. There are several factors to consider when creating a rapid extrication process for patients arriving to the emergency department by PV. First, police transport of shooting victims removes the buffer between the community and the emergency department typically provided by trained EMS. As such, standard processes for transfer from the vehicle to the emergency department and patient assessment require revision. The simulation described in this article was useful for creating processes designed to transition the patient from a PV to definitive care. For example, the simulation exposed the need to move the police drop-off site closer to the ED entrance to improve efficiency of staff access to patient. Spine stabilization was also eliminated from the extrication process after reviewing current guidance suggesting that there is no benefit, as well as the potential for irreversible neurologic deficits, with the use of this practice.[15]

Second, implementing an extrication protocol involves incorporating all necessary stakeholders from hospital security, all ED personnel, and community police. Collaboration with community police and security helps to clearly identify team member roles, appropriate drop-off sites, and communication pathways between teams. Mandatory adherence to the “Hard Stop” to allow security to conduct a search and a well-defined weapons-handling policy are important aspects to ensure the safety of ED clinicians, patients, and visitors. ED champions, identified by leadership, are essential for successful implementation of recommended processes. The champions function in a mentoring role and assist with education and monitoring adherence to defined process steps with particular focus on PPE.

Future directions include a continuous quality improvement project on patient and interdisciplinary team outcomes including the team’s satisfaction with this extrication process. This should include any untoward physical injuries to identify the need to reinforce safe transfer techniques to avoid injuries of the interdisciplinary team. In addition, we will continue to quantify the frequency of police and civilian drop-offs of patients with penetrating wounds to the emergency department compared with EMS transports and monitor the outcomes of these patients.[17] The nurses would also like to work with the police department to develop a device to help avoid the transported individuals ending up on the floor of the police vehicle to facilitate easier transfers and support individual’s dignity during the transfer.

Nurses can engage in gun violence prevention as part of a multisector approach. Per the Centers for Disease Control and Prevention, this entails providing data to inform action, conducting research, and applying effective solutions inside and outside the confines of the emergency department and promoting collaboration.[2]

In addition, emergency nurses can help facilitate the mental health healing process for victims of gun violence by referring all surviving victims of gun violence to the chaplain and for a psychiatric consult. Aftercare for their physical and psychological wounds is essential.[2]

Supplementary Data

Supplementary Appendix

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2022.01.012

Item number	Item description	Brief description from this report
1.Brief name	Provide a name or phrase that describes the intervention.	Extrication of persons from police and private vehicles
2.Why	Describe rationale, theory, or goal of the elements essential to the intervention.	To develop a process to safely and efficiently extricate traumatically injured persons arriving to the emergency department by police or private vehicle
3.What: materials	Describe materials used in the intervention. Provide where materials may be accessed.	Simulation exercise using clinicians, security personnel, police, police vehicles, PPE, stretchers, and backboards took place in the ED driveway.
4.What: procedures	Describe each of the procedures and processes used including enabling or support activities.	Simulations were run to identify proper PPE, clinician roles, drop-off location, extrication techniques, and weapons screening for traumatically injured persons arriving by police or private vehicle.
5.Who provided	For each category of intervention, describe their expertise, background, and any specific training given.	The ED CN III led the process with the assistance of the master's prepared CNS and the master's prepared nurse manager. They engaged with the city's police lieutenant who was the liaison between the city police and the emergency department. The university police and onsite security lead were also fully engaged.
6.How	Describe the modes of delivery of the intervention and whether it was provided individually or in a group.	The simulation to develop the safe and efficient processes to extricate traumatically injured patients from police or private vehicle was hands-on active learning approach. The learnings from the simulation were then communicated in groups and individually through PowerPoint presentations and real-time orientation to the process by nursing leadership.
7.Where	Describe the types of locations where intervention occurred including any necessary infrastructure or relevant features.	This process was developed for the ED driveway and entrance.

8.When and how much	Describe the number of times the intervention was delivered and over what period of time including the number of sessions, schedule, duration, intensity, or dose.	The education on the process is delivered either yearly or every other year and upon orientation. The process is reinforced with each extrication by nursing leadership.
9.Tailoring	If the intervention was planned to be personalized, titrated, or adapted, then describe what, why, when, and how.	This process can be replicated in other emergency departments but will need to be modified to address their environment. However, the PPE-required role identification and hard stop for weapons checks should not be modified to provide a safe and efficient extrication process.
10.Modifications	If intervention was modified during the course of the study, describe the changes what, why, when, and how.	The modification required during the implementation of the extrication process was reinforcement of the hard stop for weapons checks to assure the safety of the clinicians in the trauma bay.
11.How well: planned	If intervention adherence or fidelity was assessed, describe how and by whom and if any strategies were used to maintain or improve fidelity.	The CNS and CN III initially assessed the adherence to all the steps of the process in real time when they were present in the emergency department and by using the security camera footage when available. The CNS and CN III provided individual training to clinicians, typically ED technicians, RNs, and security who were challenged to adhere to the process. This resulted in greater adherence.
12.How well: actual	If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.	The CNS and CN III initially assessed the adherence to all the steps of the process in real time when they were present in the emergency department and by using a checklist and the security camera footage when available.

DETAILS

Subject:	Emergency medical care; Personal protective equipment; Mortality; Vehicles; Trauma centers; Interdisciplinary aspects; Equipment; Leadership; Emergency services; Patrol cars; Teams; Confidence intervals; Police; Nurses; Patients; Simulation; Trauma; Security staff; Private transport; Urban areas; Employees; Gun violence
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Automated Dispensing Cabinet Overrides—An Evaluation of Necessity in a Pediatric Emergency Department: JEN

ABSTRACT (ENGLISH)

Objective

Automated dispensing cabinets, or ADCs, are often used at health care facilities to aid in the medication-use process. Although ADCs minimize certain medication errors, they introduce a new type of error involving overrides. Although helpful when used appropriately in emergencies, overrides bypass pharmacist verification and increase potential for patient harm through drug-drug interactions, medication allergies, inappropriate dosing, and more. The purpose of this study was to evaluate automated dispensing cabinets override pulls in a pediatric hospital's emergency department. The authors sought to discover whether overridden medications were being administered before verification (indicating it was needed emergently, thus justifying override) or after verification (indicating the override did not result in quicker administration and/or the medication was not emergent).

Methods

This was a retrospective, observational study. Data were collected from electronic health record reports from a 343-bed pediatric hospital's emergency department from October 13, 2019, to December 22, 2019.

Results

A total of 445 override pulls were identified during this time, and after data analysis, 99 override pulls remained in the data set. Overall, time from input of prescription into the electronic medical record to medication override was approximately 4 minutes. Pharmacist verification also took a median of four minutes after prescription input. However, administration took twice as long, at 8 minutes. On average, pharmacist verification occurred 4 minutes before medication administration.

Conclusion

This research from a pediatric emergency department suggests that most situations did not require an immediate administration, and perhaps an override was unnecessary and could have been avoided.

FULL TEXT

Introduction

In 1999, the Institute of Medicine published a report, *To Err Is Human: Building a Safer Health System*,[1] to draw attention to the significant problem of medication-related errors in the health care system and to increase focus on improvements and the prevention of these errors.[2] Although this report increased awareness, there is still more work to be done. Many medication-related errors are minimal without adversely affecting patients, whereas others result in serious life-threatening events, including patient morbidity and mortality. Therefore, these errors must be taken seriously, and strategies should be established to prevent patient harm.[2]

Since the 1980s, automated dispensing cabinets (ADCs) have been used in health care facilities for storage, dispensing, and tracking of drugs in patient care units.[3] ADCs have been recommended as a potential way to increase efficiency and reduce the number of medication errors.[3] Although research shows that there are fewer errors in drug administration, fewer missing doses, and lower rates of dispensing errors with ADCs, a number of issues related to their use have surfaced.[3,4] A recent Danger Zone article, published in the *Journal of Emergency Nursing*, discusses the importance of using ADCs safely and keeping in mind the risks associated with their use.[5] The author suggests that safety gains can be achieved only with careful use of ADCs, in addition to clear practice

expectations when using the machine in patient care units.[5] Without close attention to detail, medication errors can still occur with ADC use.

ADC functionality allows for medications to be vended from the cabinet after review and verification by the pharmacist, which is the safest scenario.[2] However, there is a function imbedded into the machines, called an override, that allows a member of the patient care team to remove medications before pharmacist review and verification, specifically in emergency situations, if delay would result in patient harm.[2] The Institute for Safe Medication Practices (ISMP) has established guidelines for the safe use of ADCs to improve safety during the medication-use process.[6] ISMP states that, in some instances, overrides are occurring unnecessarily or even when a drug has not been prescribed, leading to selection and removal of the wrong medication, strength, or dose.[6] This override bypasses the important safety net of a pharmacist's expertise and clinical judgment and should be avoided if possible. Unfortunately, this override function may be misused because of inefficiencies in the system, inadequate training, lengthy wait times for pharmacist review and verification, and a lack of guidance on what is considered an emergency.[7]

The ISMP defines override as "a process of bypassing the pharmacist's review of a medication order to obtain a medication from the ADC when assessment of the patient indicates that a delay in therapy would harm the patient."[8] The idea behind an override is to shorten the time to drug administration to the patient for reasons mentioned earlier. A list of overridable medications is agreed upon by health care professionals—usually the pharmacy and therapeutics committee—in each institution where ADCs are used. This list comprised medications that would likely need to be accessed in emergency situations in which waiting for pharmacist verification would pose a risk to the patient. The overridable medications inside an ADC may vary based on the location of the patient care unit because certain medications are needed quickly in some units of the hospital but not necessarily in others. A commonly overridable medication, particularly in pediatric settings and emergency settings, is albuterol hydrofluoroalkane (HFA). This is likely caused by the utility of this medication in asthma exacerbations and bronchospasm, which are relatively emergent situations. The ADC is programmed to allow nurses to access the overridable medications without them first being verified by a pharmacist. It is impossible for a nurse to complete an override pull for a medication that is not on the approved override list.

While working in a fast-paced environment and trying to efficiently treat all patients, health care professionals sometimes get accustomed to pulling medications for which an override is possible without following all requirements. According to ISMP, necessary steps required for an override pull include ensuring that the medication has been prescribed (whether verbally or via the electronic medical record [EMR]), assessing the patient, and discerning that harm would come from a delay in administration.[8] Additional risk reduction strategies in the setting of an override include requiring documentation of override rationale, assessing the patient's allergies and weight, avoiding the use of multiple-dose containers, and using a witness with another licensed health care provider at the ADC when removing the medication.[6] Sometimes, practitioners will obtain a medication from the ADC without a specific verbal, telephone, written, or electronic prescription.[8] Often, this is incorrectly referred to as an ADC override; however, all true overrides begin with a prescription and end with a decision to not wait for a pharmacist to review the prescription before obtaining the medication from the ADC.[8]

Using the override feature of the ADC without following the proper steps of the override process is to be avoided. In addition, these overrides create the potential for medication errors given that they bypass an important review from the pharmacist of a medication's dosing, drug interactions, or life-threatening allergies.[9] Regardless of the practice setting, whether inpatient, outpatient, or in a community pharmacy, it is standard practice for a licensed pharmacist to perform a final verification for all prescriptions before medication administration. The verification step is essential for ensuring accuracy and patient safety and preventing medication errors. The series of actions associated with ADC overrides should be viewed as risky rather than routine, owing to the elimination of the important pharmacist verification step.[8] There are numerous reports of medication errors and patients being put at risk owing to medication overrides, including multiple doses of piperacillin/tazobactam being given to a patient with a penicillin allergy.[3] In a situation in which an override is not performed, the order of steps in the process is as follows:

prescription entry into the EMR, pharmacist verification of the prescription, medication withdrawal from the ADC, and then medication administration to the patient.

Hospitals that are visited by surveyors from The Joint Commission must demonstrate adherence to hospital-specific policies for reviewing overrides for medications kept in ADCs.[10] In 2018, The Joint Commission added an assessment of the ADC override process to hospitals' performance element in the medication management standard.[10] A performance element is a standard that is used to measure, assess, and improve an organization's performance.[11] Although there is no national goal for measuring override rates, health care facilities should strive for a decline in override rates.[12] As mentioned earlier, pharmacists can take an active role in evaluating and improving medication-use processes to ensure patient safety. The American Society of Health-System Pharmacists has developed guidelines to support pharmacists with recommendations and best practices for preventing medication errors in the health care system.[2] These guidelines recommend that each health care institution develop a specific criterion that allows for medication overrides in emergency situations and specify which medications can be overridden.[2] In addition, because nurses perform most transactions in the ADC, their role in error prevention is a key one. Although pharmacists are responsible for medication review and verification, nurses are responsible for medication administration; a multidisciplinary collaboration between pharmacists and nurses will optimize patient care and the safety and productivity of ADC use.[13]

The purpose of this study was to identify whether the process of medication override decreases the time it takes for medications to be administered. An additional goal was to identify whether any medications were being overridden in situations in which they did not need to be administered immediately. The primary outcome was the time difference, in minutes, between prescription verification by a pharmacist and administration of overridden medications in the pediatric emergency department. We also sought to get a better understanding of the medications that are most commonly overridden in the pediatric emergency department at our institution.

Methods

This was a retrospective observational study of patients in the emergency department in the pediatric hospital of an academic medical center. It was approved by the Vanderbilt University Medical Center Institutional Review Board with protocol identifier 202295. Override data were collected from Epic, the EMR system used at a 343-bed pediatric hospital. Data include ADC overrides in the emergency department from October 13, 2019, to December 22, 2019. During the time period that was studied, this emergency department did not have a dedicated pharmacist 24 hours a day, 7 days a week, but rather an ED pharmacist for 4 10-hour shifts per week. However, at all times there is a pharmacist tasked with prospective review of all inpatient prescriptions. An override report was run in Epic for each week during this time period; administration and verification times were collected from each patient's EMR. Override pulls that were included were for medications that had been overridden, administered to the patient, and verified by a pharmacist (either before or after administration). Override pulls were excluded if they were returned to stock, were not administered to the patient, were not verified by a pharmacist (eg, autoverified prescriptions), or were for medications whose sole purpose was to dilute or reconstitute other medications (eg, sterile water for injection). In this institution, some medications are not verified by the pharmacist because of the autoverification policy in which certain medications are subject to retrospective medication review only. Nurse-initiated standing orders or protocols are autoverified in the EMR and as such were not analyzed because pharmacist verification is not a step in this process. These prescriptions were not reviewed because they cannot be overridden. Override pulls that met any of the exclusion criteria were not analyzed further. Override data were then analyzed using descriptive statistics.

Owing to the labor-intensive process required for running the reports and performing chart review for each override pull, coupled with the time constraints of our data collection period, data were only collected for the October-to-December 2019 season. ED visits at our institution were significantly lower than usual during the first few months of the coronavirus disease 2019 pandemic and continued to be low at the time of institutional review board submission. As such, the researchers decided to conduct this study on prepandemic data which were, at the time, more indicative of what is typical for our institution.

Results

A total of 445 ADC override pulls were analyzed from this time period, of which 99 met the inclusion criteria and were not excluded because of previously mentioned reasons. Medications that were overridden are shown in Figure 1; albuterol HFA was the most commonly overridden medication in our study (n = 44). Of 99 override pulls, 72 (73%) involved medications that were administered at or after the time of pharmacist verification, with 27 of them being administered more than 5 minutes after verification (Figure 2).

Of the 99 override pulls, only 51 were associated with an electronic inpatient prescription that had already been placed before the override pull. The remaining 48 override pulls were overridden, then entered into the EMR, and then verified. As mentioned previously, one of the necessary steps of a valid override is ensuring that a prescription has been placed verbally or in writing. It is hospital policy at our institution that medications that are prescribed verbally by a provider are input into the EMR immediately by a pharmacist or nurse with verbal readback to the provider. In situations involving verbal prescriptions that have been input into the medical record, the prescriber is notified and is able to sign off on the prescription. Ideally, all medications that are prescribed verbally would be entered into the EMR, and as such, verbal prescriptions and prescriptions entered into the EMR by the provider appear similar in the medical chart. Only in circumstances where this would be detrimental to the patient (eg, an emergent situation) should a verbal “repeat back” be used and entry delayed. Owing to the retrospective nature of the study, prescriptions that were given verbally but not input into the EMR were unable to be accounted for.

Figure 3 examines the override time, which is the time it took for the nurse to pull the medication from the ADC using the override function after the medication was prescribed in the EMR. This was only evaluated for the 51 prescriptions for which the override actually took place after the prescription was entered into the EMR. Override time was a median time of 4 minutes (interquartile range [IQR] 2-7.75). The minimum override time was 1 minute, and the maximum time was 24 minutes.

Figure 4 examines the verification and administration times. Verification time is the length of time, in minutes, it took for the pharmacist to verify the prescription after it was placed electronically. The median time to verification was 4 minutes (IQR 1.5-8 minutes). The minimum time to verification was 0 minutes, and the maximum time was 71 minutes. Regarding albuterol HFA only, the median time to verification was 5 minutes with a maximum time to verification of 29 minutes.

Administration time is the length of time, in minutes, it took for the nurse or other practitioner to administer the medication after the medication had been overridden. The median time to medication administration was 8 minutes (IQR 5-14.5 minutes). The minimum time to medication administration after override was 1 minute, and the maximum time was 140 minutes. Regarding albuterol HFA only, the median time to administer the medication after the override was 17.25 minutes.

Figure 5, delay time, is the amount of time the nurse would have had to wait to pull the medication from the ADC without performing an override pull. This value was only calculated for prescriptions that were input into the EMR before being overridden and were not already verified at the time of override pull. There were 23 pulls that met these criteria of being appropriately overridden and had an associated delay time calculated; 19 of those (83%) involved a delay time of ≤5 minutes. Five of these actually had a delay time of 0 minutes, meaning that the override pull occurred at the same time as the pharmacist verification step.

Discussion

In the pediatric emergency department at this academic medical center, there were override pulls initiated before the prescription was entered into the EMR. There were also scenarios in which the override process may not have been necessary to ensure prompt administration of medications, based on the times of prescription input, override, verification, and administration. Verification is an extremely important step of the medication-use process and is often done promptly enough to bring the necessity of override pulls into question. On average, pharmacist verification happened more quickly than nurse administration. The fact that the median time to administration was 8 minutes after override time and took place after pharmacist verification suggests that most situations did not necessitate immediate administration of the medication, and perhaps an override was unnecessary in those

situations. Medication overrides occurred a median of 4 minutes after prescription input, whereas pharmacist verification occurred a median of 4 minutes after prescription input. However, medication administration often occurred after medication verification despite the potential delay. In addition, the fact that one of the medications was administered 140 minutes after being pulled is concerning because it indicates that the situation was not emergent and therefore did not necessitate a true override. Furthermore, many of the medications that were pulled using the override feature were either returned to stock or simply not administered at all, which means that the medications were not actually needed by the patient. The results regarding delay time mean that even in situations where medications were overridden appropriately (only about one-fourth of the overridden medications), most of them would not have had to be overridden if the nurse could have waited 5 minutes for verification.

The most common order of steps that occurred was as follows: prescription input into EMR, medication pulled via override function, prescription verified by pharmacist, and finally medication administered to patient. The results from Figure 2 led to the conclusion that only approximately 27% of the overriden prescriptions were definitely administered more quickly through the override process than they would have been had they not been overridden. Approximately 45% of the override pulls may or may not have involved time saved because of being overridden (administered 0-5 minutes after verification), because if the nurse had waited until verification before pulling the medication, they might have had to administer the medication later than they actually did using the override process. Approximately 27% of the overridden medications were overridden unnecessarily because these prescriptions were actually verified quickly enough that they could have been pulled without override and still administered at or before their actual time of administration.

This study has several strengths. First, owing to the paucity of data regarding this topic, this research can aid in informing health care providers and decision makers about the prevalence of medication overrides and how appropriately (or inappropriately) they are being performed. In addition, the fact that this study was retrospective and observational in nature ensured that neither pharmacists nor nurses altered their behavior or workflow because of knowing that the study was taking place. Finally, all information was extracted directly from the medical record and did not rely on coding.

A limitation of this study is that the extensive exclusion criteria, although improving the specificity of our data set, significantly decreased the number of override pulls that could be further analyzed. Furthermore, time constraints on our data collection period prevented us from collecting data from a broader range of time. Not having a comparator group of medications that were dispensed from the ADC through the normal process (not overridden) also limits the interpretation of the results of this study. In addition, times in the EMR are listed in hours and minutes. The fact that seconds are not recorded and displayed makes the calculations of time differences slightly less specific. Another limitation of this study is the potential for small time inaccuracies in charting. For example, a nurse who administered a medication at 6:07 might not have charted it until 6:08 or may have estimated that she administered it at 6:05. In addition, the method of data collection made it impossible to account for verbal prescriptions before they had been recorded in the medical record. Finally, the single pediatric medical center and retrospective design of this study limit the interpretation and generalizability of the results.

Implications for Emergency Clinical Care

This research highlights the potential need for further education regarding the risks associated with the override process and the importance of performing overrides properly. Health care professionals would likely benefit from an update or reminder of the override protocol in their respective medical centers. The ISMP has articles that would be helpful in this endeavor.[8] In addition, education should be provided on methods to avoid overrides if possible, such as paging or calling the pharmacist to ask for an important medication to be verified promptly.

Nurses and other practitioners who use the override feature in an ADC should ensure that a verbal or written prescription is placed before the medication is overridden. Furthermore, it should be reiterated that just because a medication is on the list of those that can be overridden does not mean that practitioners should be in the habit of overriding that medication if it is unnecessary to do so.

Conclusions

In the pediatric emergency department of this academic medical center, the progression of steps involved in the override process often indicated that medications could have undergone the usual process of being verified before being pulled (ie, not being overridden) and still be administered at or before the administration time that was achieved using the override feature. The pattern of utilization of the override option in ADC calls into question whether the override was necessary in these instances. In effect, if a patient truly needed a medication emergently, why was the medication not administered as soon as possible after being pulled from the ADC?

A medication override is meant to achieve more efficient administration of certain medications in situations that require quick action to prevent patient harm, but every override comes at a cost—with each override, the important step of pharmacist verification is bypassed, an omission that could lead to patient harm. Pharmacist verification helps to ensure medication safety and appropriateness before administration, thus reducing the risk of medication errors and improving patient care. As such, this step's importance should not be overlooked or undervalued, and bypassing it should be avoided as much as possible. Health care institutions should continually assess policies associated with medication overrides and aim to decrease override frequency, specifically in the emergency department.

Further research is needed to determine the effects of unnecessary medication overrides, including potential or actual patient harm. Ideally, this study could be continued to obtain a more robust picture of the nature of overrides in this institution over a longer period of time. This would account for seasonal variations in medication use and ED visits. A potential future study could be conducted prospectively to reduce possible bias from reviewing data retrospectively, but would introduce a new type of bias as nurses and/or pharmacists may change their behaviors if they were to know they were being monitored for a study. In addition, a control group of medications that have undergone a normal medication-use process (ie, those that have not been overridden) would provide meaningful comparison to the study results. A list of excluded override pulls and the reason for exclusion should be extensively documented. An analysis of the presence of a pharmacist in the department should be performed to analyze their role on medication verification time. There is a need to eliminate for confounding variables between accurate medication administration time and time documented in the medical record, especially in critical, high-acuity situations. Finally, a list of approved overridable medications would strengthen this research; however, this information is institution specific and is confidential information that cannot be shared with individuals outside the institution.

We urge other institutions and other departments of our own institution to evaluate their utilization of the override process and ensure that this strategy is being implemented to improve patient care rather than unnecessarily put patients at risk.

Author Disclosures

Conflicts of interest: none to report.

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A Modified Aerosol Mask Could Significantly Save Oxygen Supplies during SARS COV 2 Pandemic: JEN

ABSTRACT (ENGLISH)

Of note, the World Health Organization recently published an interim guide on oxygen source and distribution during the COVID-19 pandemic, estimating that an average of 90 m3 of oxygen per hour would be necessary to cover the needs of a hospital managing 100 concurrent COVID-19 cases.2 Unfortunately, epidemic waves have put health care systems under stress, and oxygen supply scarcity has been encountered in some regions of the world, such as India, Africa and Latin America.3 Oxygen supply and oxygen-saving strategies are thus of utmost importance for those regions. In addition to hospital use, an online video tutorial (shared by a Quick Response-code on oxygen bottles) or documentation included with oxygen bottles could allow implementation of this simple device among the population for at-home care. In addition to saving oxygen, proper use of this device could have a significant economic impact on and reduce the risk of catastrophic health expenditure faced by families taking care of their relatives at home because of overwhelmed hospitals.—Duprez F, PT, RT, PhD, ICU Epicura Hospital Hornu Belgium and Laboratory of Motion and Respiratory Physiology Condorcet School, Tournai, Belgium; De Terwangne Ch, MD, PhDs, Deparment of Geriatric Medicine, Université Catholique de Louvain, Brussels, Belgium; Poncin W, RT, PhD, Service de Pneumologie, Cliniques; and secteur de Kinésithérapie et Ergothérapie, Cliniques Universitaires Saint-Luc, Brussels, Belgium; Bruyneel A, RN, CCRN, PhDs, Health Economics, Hospital Management and Nursing Research Department, School of Public Health, Université Libre de Bruxelles, Brussels, Belgium.

FULL TEXT

Dear Editor:

Coronavirus disease (COVID-19) is predominantly a respiratory illness that can evolve to hypoxemic respiratory failure. In those cases, oxygen therapy is used as first-line treatment and is still the most supportive treatment of the disease.[1] Therefore, oxygen supply is key for an effective health care response, and meeting the surging oxygen demand is vital during the COVID-19 emergency. Of note, the World Health Organization recently published an interim guide on oxygen source and distribution during the COVID-19 pandemic, estimating that an average of 90 m^3 of oxygen per hour would be necessary to cover the needs of a hospital managing 100 concurrent COVID-19 cases.[2]

Unfortunately, epidemic waves have put health care systems under stress, and oxygen supply scarcity has been encountered in some regions of the world, such as India, Africa and Latin America.[3] Oxygen supply and oxygen-saving strategies are thus of utmost importance for those regions.

To treat severe hypoxemia, the main systems currently used are the non-rebreathing mask or high flow nasal oxygen.[4] However, these systems consume large amounts of oxygen and have thus limited usefulness in places where hospital capacities are overwhelmed and oxygen storages have been depleted.

The Modified Aerosol Mask (MAM) is an original handmade oxygen delivery system that can be self-assembled with few and easily available disposables. Indeed, the MAM is made of 1 aerosol mask onto which 2 pieces of corrugated tubing (15 cm length) are connected (Figure 1). The whole system is placed above the classical nasal cannula (NC), which remains the source of oxygen distribution. During expiration, the continuous oxygen flow from the NC is collected in the 2 tubes instead of being immediately dispersed into the room. During the next inspiration, the patient will receive, when inspiratory flow exceeds NC flow, this oxygen-enriched gas mixture from the tubes instead of atmospheric room air. Of course, once the tidal volume exceeds the mask and tubing volume (210 mL), atmospheric air will penetrate the tubes and will be inspired by the patient. In doing so, the increased dead space from the corrugated tubes of the MAM theoretically acts as a collector of wasted oxygen during the expiratory phase or in the case of mouth breathing (Figure 2). This set up may have the advantage of increasing the fraction of inspired oxygen for a given oxygen flow delivered by NC, without clinically significant arterial CO_2 increase.[5] Hence, for this fraction

of inspired oxygen, the addition of the MAM allows lower oxygen flows and thereby saves oxygen supplies. The MAM can spare up to 50% of oxygen flow while preserving a target arterial oxygen pressure.[6] This mask is an experimental prototype, used under an emergency exemption and with approval from the two main ethics committees of our country. The device has not yet been approved for use in the United States. The MAM can be used with either oxygen cylinders or oxygen concentrators. This device could thus be valuable in those countries in need of enormous amounts of oxygen and undergoing actual oxygen scarcity. In addition to hospital use, an online video tutorial (shared by a Quick Response-code on oxygen bottles) or documentation included with oxygen bottles could allow implementation of this simple device among the population for at-home care. In addition to saving oxygen, proper use of this device could have a significant economic impact on and reduce the risk of catastrophic health expenditure faced by families taking care of their relatives at home because of overwhelmed hospitals.—

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Infrared Vein Imaging for Insertion of Peripheral Intravenous Catheter for Patients Requiring Isolation for Severe Acute Respiratory Syndrome Coronavirus 2 Infection: A Nonrandomized Clinical Trial: JEN

ABSTRACT (ENGLISH)

Introduction

Establishing intravenous access is essential but may be difficult to achieve for patients requiring isolation for severe acute respiratory syndrome coronavirus 2 infection. This study aimed to investigate the effectiveness of an infrared vein visualizer on peripheral intravenous catheter therapy in patients with coronavirus disease 2019.

Methods

A nonrandomized clinical trial was performed. In total, 122 patients with coronavirus disease 2019 who required peripheral intravenous cannulation were divided into 2 groups with 60 in the control group and 62 in the intervention group. A conventional venipuncture method was applied to the control group, whereas an infrared vein imaging device was applied in the intervention group. The first attempt success rate, total procedure time, and patients' satisfaction score were compared between the 2 groups using chi-square, *t* test, and *z* test (also known as Mann-Whitney U test) statistics.

Results

The first attempt success rate in the intervention group was significantly higher than that of control group (91.94% vs 76.67%, 2 = 5.41, $P = .02$). The procedure time was shorter in the intervention group (mean [SD], 211.44 [68.58] seconds vs 388.27 [88.97] seconds, $t = 12.27$, $P < .001$). Patients from the intervention group experienced a higher degree of satisfaction (7.5 vs 6, $z = -3.31$, $P < .001$).

Discussion

Peripheral intravenous catheter insertion assisted by an infrared vein visualizer could improve the first attempt success rate of venipuncture, shorten the procedure time, and increase patients' satisfaction.

FULL TEXT

Contribution to Emergency Nursing Practice

••Evidence on peripheral intravenous access assistive technology has mainly applied to venipuncture in children.

••Infrared vein imaging may help nurses improve the peripheral intravenous access first attempt success rate, efficiency, and patient satisfaction among adult patients under pandemic infectious respiratory disease isolation conditions.

••The results of this nonrandomized study support the use of infrared vein imaging among adult emergency patients who require infectious disease isolation that may create difficulty in performing peripheral intravenous access procedures.

Introduction

Coronavirus disease 2019 (COVID-19) is highly contagious and transmissible, requiring isolation precautions during treatment. Respiratory droplets and close contact were recognized as the major virus transmission routes in the early phases of the pandemic, and the population is generally susceptible.[1] Therefore, patients must be treated in isolation conditions, and health care staff needs to wear personal protective equipment. In many international settings, the required personalized protective equipment included goggles.[2] This personalized protective equipment presents challenges and additional workload when providing nursing care. The evaporated body heat forms water vapor in goggle glasses, which may block nurses' eyesight. Moreover, wearing an extra layer of gloves negatively affects the palpating sensation. Nursing responsibilities commonly include peripheral intravenous cannulation (PIVC). Traditionally, nurses rely on their senses of sight and touch to perform PIVC. However, under isolation ward

conditions described in earlier text, nurse proceduralists may not be able to see the vein clearly and assess the venous elasticity well, making venipuncture particularly difficult.

The infrared vein imaging device emits infrared wavelength of 4 to 400 μm with a 3 to 5 cm penetration depth to pass through the skin and subcutaneous fat efficiently. On absorbing the infrared wave, the vein turns blue-green. Hence, the distribution and direction of subcutaneous veins, especially those invisible to the naked eye, can be clearly displayed by an infrared vein imaging instrument.[3] In brief, infrared imaging could facilitate the identification of the most suitable blood vessels for PIVC. Accordingly, the first attempt success rate may be increased, and the total procedure time may be shortened using the infrared imaging device to locate suitable PIVC sites. Evidence from a review of the literature indicates that infrared vein imaging technology is effective in improving PIVC outcomes, especially for patients with less visible veins.[4,5] Sun et al[6] reported that the near-infrared (NIR) vein-viewing device could help decrease the time for finding the first available blood vessel (mean = 383.61, SD = 112.14 vs mean = 126.37, SD = 26.33 seconds) and decrease the number of PIVC attempts (2 vs 1 median of attempts per patient) in critically ill children.[6] In a systematic review, Park et al[7] concluded that the use of an NIR device did not influence the overall failure rate at the first attempt of PIVC in pediatric patients. However, in a subset of patients at high risk, which were determined by the clinician's subjective rating of difficulty or an objective index for difficulty (difficult intravenous access score or skin color grading), using NIR light devices showed a lower risk for PIVC failure than the traditional method. Patients with poor vascular conditions in isolation wards may be considered high risk for PIVC failure. Previously, we have applied infrared vein imaging assisted venipuncture in patients with rheumatic diseases with increased efficiency (procedure time shortened from an average of 382.11 seconds to 203.06 seconds).[8] To our knowledge, no similar study on NIR light devices and PIVC outcomes has been conducted with patients in COVID-19 isolation settings. To address the gaps in the literature, combined with our own experience under the COVID-19 disaster conditions, this present study aimed to evaluate the effectiveness of the infrared vein visualizer on PIVC outcomes for patients in COVID-19 isolation.

Hypothesis

Our hypothesis was that the intervention group with the infrared vein visualizer for PIVC would demonstrate (1) increased success rate at the first attempt, (2) shorter procedure time, and (3) increased satisfaction compared with the control group.

Methods Study Design

This was a nonrandomized, double-blinded by not knowing the conditions under study, and controlled clinical trial performed in patients of the COVID-19 isolation wards from February 2020 to April 2020. The study was conducted in Tongji hospital (Wuhan, China), where each unit contained 50 beds and 30 working staff during the COVID-19 outbreak.

Participant Allocation

A randomization method was not adopted because it was difficult to conduct grouping in the isolation environment and justify under the rapidly changing disaster conditions. The control group and the intervention group were from 2 different COVID-19 isolation wards, respectively. The control group adopted the traditional venipuncture approach. The intervention group adopted the infrared vein visualizer–assisted approach. The study followed TREND guideline guidance.[9]

Participant Inclusion and Exclusion Criteria

Patients (all adults aged ≥18 years) were enrolled from 2 isolation wards of the same hospital where patients who were severe and critically ill with COVID-19 were treated. Inclusion criteria for patients included the following: (1) patients positive for severe acute respiratory syndrome coronavirus 2 nucleic acid test with ground-glass shadow on

computed tomography image of bilateral lungs; (2) patients needing PIVC; and (3) patients with veins classified as level 0 to 2 according to the standard proposed by Li et al[10] as follows:

••Level 0: Subcutaneous superficial thick veins at the back of the hand and foot or thick veins at the forearm and wrist. Veins prominently protrude on the skin surface with good tension, fixed shape, and an elastic, soft touch.

••Level 1: Subcutaneous superficial small- and medium-sized veins at the back of the hand and foot or medium-sized veins at the forearm and wrist. Veins slightly protrude on the skin surface, and they are touchable but not stiff.

••Level 2: Obscure small veins at the back of the hand and foot or small veins in the fingers. Veins are non-fully filled, less palpable, and partially stiff.

••Level 3: Obscure small veins at other sites. Subcutaneous veins are stiff, hardly palpable, and/or accompanied with phlebitis.

Exclusion criteria were as follows: (1) patients with unstable vital signs, unconsciousness, or restlessness related to conditions such as shock, respiratory failure, and multiorgan dysfunction; and (2) veins at level 3.

Proceduralists

Nurse proceduralists were required to have at least 3 years working experience with solid competency and success rate of venipuncture outside the COVID units. All nurses on the intervention unit received training on how to operate the infrared instrument (Type AV300, Accu Vein Company, USA).

Outcome Measures

The effectiveness of an infrared vein visualizer on PIVC was evaluated by the success rate at the first-time attempt, procedure time, and patients' satisfaction degree. A successful PIVC satisfied the following criteria: (1) after the intravenous indwelling needle puncture, there was blood return; (2) once the needle was immobilized and the infusion speed was accurately adjusted, 100 mL of intravenous fluid was successfully injected without evidence of extravasation.

Procedure time referred to the time spent from placing a tourniquet on the upper arm to the accomplishment of venipuncture and was recorded by the data collector. Patients' satisfaction degree on the PIVC procedure was determined by a 0 to 10 visual analog scale scoring with 0 denoting the most unsatisfactory and 10 denoting the most satisfactory.

Sample Size

Referring to previous studies[5,6] in which approximately 30 patients were included in each group with the same intervention and outcome measurement adopted, this study expanded the sample size to 60 patients in each group.

Data Collection Procedures

During the daily operation, a specified data collector who was a nurse qualified in PIVC was assigned to record the success rate of the first attempt, the time taken for the venipuncture, and the satisfaction score immediately after the venipuncture was completed. We recorded the patients' general information such as sex, age, and blood pressure. Data on chronic disease status known at the time as the most common chronic diseases related to COVID-19 susceptibility and severity were collected (hypertension, diabetes, coronary heart disease, chronic renal failure, chronic obstructive pulmonary disease). Finally, the proceduralist nurse's years of working experience were also recorded. Data were entered initially on a paper form. The form was taken from the isolation ward and entered in the computerized software. One member of the research team entered the data, and a second verified the data entry for accuracy.

Statistical Analysis

The data were entered in the SAS 9.4 software. Ratio and median were used to describe the count data (first attempt success rate and satisfactory score). The mean and SD were used to describe the quantitative data (procedure time). Student *t* test was used to analyze the difference in time taken for venipuncture between the 2 groups. Chi-square test was used to analyze the difference in the success rate of the first venipuncture. The *z* test (Mann-Whitney U test) was used to analyze differences in patients' satisfaction. The 2-tailed α level was set as .05.

Ethical Considerations

All patients provided verbal informed consent and voluntarily engaged in this study. The study was approved by the medical ethics committee of the Tongji Hospital Affiliated to Tongji Medical College of Huazhong University of science and technology before implementation (IRB approval number: TJ-C20200157).

Results Samples and Characteristics of Participants

A total of 122 patients with COVID-19 were enrolled in the study, which was carried out by 8 nurses (4 nurses in each group). There were 62 patients in the intervention group and 60 patients in the control group. The demographic data for the 122 patients are summarized in [Table 1]. There were no significant differences between the 2 groups in sex, age, blood pressure, and chronic diseases status.

Outcomes

The outcomes measured were the first attempt success rate, total time taken to accomplish a successful PIVC, and patient satisfaction with the procedure. In the intervention group, 57 cases were successful with a first attempt success rate of 91.94%. In the control group, 46 cases were successful, and the first attempt success rate was 76.67%. The first attempt success rate in the intervention group was significantly higher than that of the control group (^{2} = 5.41, *P* = .02). In the intervention group, it took an average of 211.44 seconds to complete the PIVC procedure, whereas the time was 388.27 seconds in the control group. The total time taken to complete the PIVC was significantly shorter in the intervention group than the control group (*t* = 12.27, *P* z = −3.31, *P* Table 2.

Discussion

Our results suggest that the use of an infrared vein visualizer for cannulation in patients with severe COVID-19 was effective in increasing the first attempt success rate, reducing total operating time, and improving patients' satisfaction. This provides an important additional method to standard care to facilitate PIVC under COVID-19 isolation conditions.

PIVC is widely used in clinical nursing practice. In some cases, inserting an intravenous cannula can be a challenge even for experienced nursing personnel. Failed cannulation is more likely among children and patients with darker skin tones in which the veins are more difficult to visualize, anxiety, critical illness, and chronic disease.[11–15] Older adults and those with complications such as chronic obstructive pulmonary disease, diabetes, hypertension, and heart disease are at an increased risk of COVID-19 infection.[16] These previously documented COVID-19 risks are consistent with our finding that approximately half of the patients suffer from pre-existing chronic diseases. All subjects in our study were severe COVID-19 cases. COVID-19 not only causes physical health declines but also results in a number of psychological complications.[17] One month after hospital discharge, 42% of COVID-19 survivors still suffered from anxiety.[18] Given that chronic disease and patient anxiety are also risk factors for failed PIVC, the PIVC procedure when the proceduralist is wearing personal protective equipment in the COVID-19 isolation ward combines to make the procedure more difficult.

For nurse proceduralists, the special environment of the COVID-19 isolation ward also increased the difficulty of PIVC. In our isolation wards, health care workers must wear protective clothing and goggles, which can slow their actions, extend working time, complicate the assessment of patients' veins, and delay the PIVC insertion procedure. In addition, the nurses were required to put on several layers of rubber gloves in the isolation wards, which made it

difficult to palpate the thickness, elasticity, and direction of blood vessels. Thus, longer time was needed for vessel selection for patients in COVID-19 isolation. Once the tourniquet is applied, lengthy periods of time spent on searching for suitable veins can also cause several unwanted effects such as pain, trauma, and subcutaneous bleeding. In the care of patients with COVID-19 in isolation, PIVC is at a high risk of failure at the first attempt. Failure of PIVC not only increases the pain for the patient but may also bring added anxiety and stress to the patient and proceduralist, making subsequent PIVC attempts increasingly challenging. Stevens et al and others have reported that improper venipuncture may lead to peripheral nerve injury and many other adverse consequences.[19–21] Walsh[22] pointed out that multiple venipuncture attempts can heighten patient anxiety and suffering, delay vital treatment, and increase costs.

For many years, researchers have been investigating the state-of-art venipuncture technologies, and at the same time, various tools, and methods[23,24] have been developed to improve the success rate of venipuncture in clinical practice. The application of devices to visualize subcutaneous vessels and nerves is particularly useful for novice proceduralists and may improve the success rate in patients requiring special care, such as patients who are elderly, children, or obese, or those with darker skin tones whose veins are difficult to identify with unassisted eyesight or palpation.[25]

In addition to the infrared device, ultrasound may also be used to assist in the PIVC procedure. The efficacy of ultrasound has been reported; however, ultrasound is expensive and requires substantial skill.[26] Our results with an infrared vein visualizer were consistent with the findings of Sun et al[6] that the application of vein visualizers improved the first attempt success rate and shortened the procedure time. In opposition to our findings, several other studies [27–29] did not report a benefit to using infrared venous visualization technique in pediatric patients. The difference may be attributed to benefits specific to adult patients with severe COVID-19 in isolation conditions and our exclusion criteria for patients with level 3 veins. This difference may be further explained by the following specific reasons. First, patients varied greatly in disease condition and age. Second, the special COVID-19 isolation environment made traditional PIVC a procedure with a high risk of failure compared with nondisaster clinical conditions. Third, our patients were all Asian with a skin color that varied less than a study sample inclusive of patients who identify as Black, White, Indigenous, Pacific Islander, or multiracial.

In this study, the difference in patients' satisfaction scores between the 2 groups was statistically significant. Venipuncture, as the initial step of intravenous infusion treatment, is an invasive procedure. The failure of venipuncture increases both the pain that patients experience and the pressure for nurses, which can even cause interpersonal tension by potentially creating a decrease in patient trust in the clinical competency of the nurse. In particular, patients with COVID-19 are more likely to be elderly people with poor vascular condition, and the isolation wards further make venipuncture more difficult. By using an infrared vein visualizer, the satisfaction of patients may be significantly improved, thereby supporting a more trusting, therapeutic, and harmonious relationship between patients and nursing staff.

For future research, randomized and controlled trials are recommended to further test the efficacy of infrared vein visualizers. Such application can also be encouraged in other emergent and/or nonemergent clinical conditions, wherein a high quality of PIVC is demanded.

Limitations

This study had several limitations. First, the sample size was relatively small and collected in 2 units in only 1 Chinese hospital setting. Patients in our sample were not racially diverse. Thus, generalizability may have been limited. Second, owing to the constraint of the disaster conditions, we did not randomize the groups. Third, the nurse proceduralists were required to grasp this new technique in a short period of time under new disaster working

conditions. Fourth, we did not collect data on the total number of PIVC attempts per patient.

We also assessed the risk of bias on the basis of the Risk of Bias in Non-randomized Studies of Interventions tool.[30] (1) Confounding: The potential confounding bias could result from prognostic variables related to vascular condition. In our study, patients with vein levels of 0 to 2 were included for PIVC. Because of the emergent and isolation condition, further stratification of patients was not conducted. Thus, this may bring bias into the study. (2) Selection bias: The included samples comprised severe COVID-19 cases with yet stable vital signs. Although we had objective inclusion and exclusion criteria, minor bias may still exist. (3) Bias in measurement classification of interventions: The satisfactory score of patients could have been affected by their psychological state and practices unrelated to the PIVC procedure. (4) Bias in measurement of outcomes: The study was carried out by 2 groups of nurses in 2 different isolation wards. Despite standardized training for the nurses, there could have been possible bias regarding intervention fidelity and outcome measurement. Since the study was conducted in a blinded manner and the patients were more than willing to participate in the research, no missing data generated during the study and the bias resulting from intended intervention and selection of reported results could be neglected. Overall, this study had moderate risk of bias compared with a well-performed randomized trial.

Implications for Emergency Clinical Care

Our study has implications for emergency clinical practice. In the emergency department, nurses perform PIVC in a wide variety of patient acuity, age, and isolation conditions. In the case of patients who need urgent intravenous access, if the vascular condition is poor and the venipuncture is difficult, it may increase nurse workload and stress. Difficult PIVC may delay patient rescue and resuscitation in the ED setting. Under COVID-19 isolation conditions, infrared technology to assist PIVC may improve the success rate at first attempt, decrease procedure time, and increase patient satisfaction with the procedure. We recommend that bedside infrared imaging devices and proceduralist training to use the devices be made available to emergency nurses caring for adult patients who require COVID-19 isolation.

Conclusion

Nurses may encounter difficulty when performing PIVC under disaster and COVID-19 isolation conditions. The application of infrared venipuncture assistive technology in patients with COVID-19 could improve the first attempt success rate, shorten the total procedure time, and enhance patients' satisfaction.

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Author Disclosures

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Characteristics	Control n = 60	Intervention n = 62	Statistics	P value

Mean or n	SD or %	Mean or n	SD or %	Test	Value	Age, y, mean (SD)	55.75
10.68	55.79	11.10	t	−0.02	.98	Sex, n (%)	
						Female	21
35.00	24	38.71	χ^2	0.18	.67	Male	39
65.00	38	61.29				Blood pressure, mm Hg, mean (SD)	
						Systolic	118.01
8.89	120.90	11.67	t	−1.55	.12	Diastolic	72.27
8.24	73.82	8.34	t	−1.04	.30	Comorbidities, n (%)	

						Hypertension	18
30.00	19	30.65	χ^2	0.01	.94	Diabetes	13
21.67	7	11.29	χ^2	2.40	.12	Coronary heart disease	2
3.33	6	9.68	Fisher	–	.27	Chronic renal failure Chronic obstructive pulmonary disease	34

Index	Control n = 60	Intervention n = 62	Statistics	P value

Mean, n, or median	SD, %, or IQR	Mean, n, or median	SD, %, or IQR	Test	Value	Procedure time, s, mean (SD)	388.27
88.97	211.44	68.58	t	12.27	< .001	First attempt success rate, n (%)	
						Success	46
76.67	57	91.94	χ^2	5.41	.02	Failure	14
23.33	5	8.06				Patients' satisfaction degree, score, median (IQR)	6

DETAILS

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Emergency Nurses Recognize a Need for Education of Delirium Prevention and Management in the

Emergency Department: JEN

ABSTRACT (ENGLISH)

Resources to fill gaps in knowledge and training include the geriatric ED guidelines, which recommend protocols to address delirium in the emergency department,4 and a recently published toolkit to aid emergency departments in implementing delirium programs, which includes educational materials for ED staff.5 Providing emergency nurses with appropriate support to address ED delirium is one critical component toward improving emergency care for older adults.—Anita N. Chary, MD, PhD, Department of Emergency Medicine, Department of Internal Medicine, Center for Innovations in Quality, Effectiveness and Safety, Baylor College of Medicine, 1 Baylor Plaza, Houston, TX 77030; E-mail: anita.chary@bcm.edu. Twitter: @EmilyWeaver_WHI, ORCID identifier: https://www.doi.org/0000-0003-4354-7797; Adriane Lesser, MS, MBA, West Health Institute, San Diego, CA.Twitter: @AdrianeLesser, ORCID identifier: https://www.doi.org/0000-0003-3226-5022; Sharon K. Inouye, MD, MPH, Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, and the Aging Brain Center, Marcus Institute for Aging Research, Hebrew SeniorLife, Boston, MA. Twitter: @GeriatricEDNews, ORCID identifier: https://orcid.org/0000-0002-2603-7157; Maura Kennedy, MD, MPH, Department of Emergency Medicine, Massachusetts General Hospital, Boston, MA and Harvard Medical School, Boston, MA.

FULL TEXT

Dear Editor:

A recent article in the *Journal of Emergency Nursing*, Delirium in the Emergency Departments: Is It Recognized? by El-Hussein et al,[1] highlights key challenges for emergency nurses in recognizing ED delirium and using common delirium screening tools. This work points to a need for standardized training for emergency nurses on delirium screening tools and for policy change to integrate delirium tools into organizational practice. We support the arguments advanced in this important article and present 2 additional and novel points about (1) emergency nurses' self-perceived knowledge of delirium recognition, and (2) institutional prioritization of delirium detection.

We conducted a survey-based study of emergency nurses' knowledge, practices, and perceived need for resources regarding delirium in older ED patients.[2] The survey—released by the West Health Institute, a nonprofit, nonpartisan organization dedicated to geriatric medical research—queried members of the Emergency Nurses Association. The survey was posted on the West Health Institute website, LinkedIn, and Twitter accounts and was promoted at several relevant professional conferences. A convenience sample of 65 Emergency Nurses Association members from 15 states participated in the survey.

One major finding from our survey, not previously observed in the article by El-Hussein et al,[1] is a disconnect between emergency nurses' self-reported high knowledge of delirium detection and low ED delirium detection rates.[2] When asked to rate their own knowledge, most respondents reported intermediate or advanced skills in delirium detection (76.9%) and management (73.8%). This contrasts with previous research demonstrating that the majority of ED delirium goes undetected.[2] At the same time, however, respondents identified as a key challenge an overwhelming need for education on delirium for nurses (82%), echoing findings by El-Hussein and others.[3] Specific knowledge gaps identified by respondents included identifying delirium in patients with dementia (66%) and lack of recognition of the hypoactive delirium subtype (58%).

Our survey also demonstrates a gap between emergency nurses' and institutional prioritization of ED delirium detection. More than half (59%) of respondents thought that delirium detection in the emergency department was very or somewhat important, but less than one-third (32%) of respondents reported that the emergency department where they work has a protocol to address delirium, whereas 31% said that none was available, and 37% were unsure. As also observed by El-Hussein and colleagues, our survey data reveal a preference for the confusion

assessment method (CAM) as a recognition tool. Among those emergency nurses working in institutions with delirium protocols, the majority reported their emergency department's delirium screening tool as the CAM (61%) or brief CAM (13%).

These results confirm and add to the findings by El-Hussein et al,[1] underscoring the need for education for emergency nurses and organizational policy change to implement delirium protocols in emergency departments. Resources to fill gaps in knowledge and training include the geriatric ED guidelines, which recommend protocols to address delirium in the emergency department,[4] and a recently published toolkit to aid emergency departments in implementing delirium programs, which includes educational materials for ED staff.[5] Providing emergency nurses with appropriate support to address ED delirium is one critical component toward improving emergency care for older adults.—*Anita N. Chary, MD, PhD, Department of Emergency Medicine, Department of Internal Medicine, Center for Innovations in Quality, Effectiveness and Safety, Baylor College of Medicine, 1 Baylor Plaza, Houston, TX 77030; E-mail: anita.chary@bcm.edu*. ***Twitter:*** *@anitachary*, ***ORCID identifier:*** https://www.doi.org/0000-0002-8839-7617*; Emily H. Weaver, PhD, MA, West Health Institute, San Diego, CA.* ***Twitter:*** *@EmilyWeaver_WHI*, ***ORCID identifier:*** *https://www.doi.org/0000-0003-4354-7797; Adriane Lesser, MS, MBA, West Health Institute, San Diego, CA.****Twitter:*** *@AdrianeLesser,* ***ORCID identifier:*** https://www.doi.org/0000-0003-3226-5022*; Sharon K. Inouye, MD, MPH, Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, and the Aging Brain Center, Marcus Institute for Aging Research, Hebrew SeniorLife, Boston, MA.* ***Twitter:*** *@sharon_inouye*, ***ORCID identifier:*** *https://www.doi.org/0000-0002-3663-2937; Christopher R. Carpenter, MD, MS, Department of Emergency Medicine, Barnes Jewish Hospital, Washington University in St. Louis, St. Louis, MO.* ***Twitter:*** *@GeriatricEDNews*, ***ORCID identifier:*** *https://orcid.org/0000-0002-2603-7157; Maura Kennedy, MD, MPH, Department of Emergency Medicine, Massachusetts General Hospital, Boston, MA and Harvard Medical School, Boston, MA.* ***Twitter:*** *@MauraKennedyMD*, ***ORCID identifier:*** https://www.doi.org/0000-0002-8755-7324*; and Amy R. Stuck, RN PhD, West Health Institute, San Diego, CA.* ***Twitter:*** *@DrRNAmy*, ***ORCID identifier:*** https://www.doi.org/0000-0001-8339-1227*.*

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The Common Nightingale: JEN

FULL TEXT

Rhyming isn't easy
When you don't set the tempo
And your patients sing in different keys
And you have two too many sopranos
And the patient in bed 32 is urinating on the wall
Known for their song, the common nightingale

A ground nester
A migratory species
A relentless serenador
Fashioning nests for each of my loving sufferers
Burdened with my decisions
My lyrics, her melody
My feathers are too wet, but she continues to fly
Not so common, are they?

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A Comparison of Two Different Tactile Stimulus Methods on Reducing Pain of Children During Intramuscular Injection: A Randomized Controlled Study: JEN

ABSTRACT (ENGLISH)

Introduction

Pediatric patients in the emergency department often require intramuscular injection procedures, which may lead to pain, fear, and anxiety. The purpose of this study was to test a novel nonpharmacological intervention to reduce needle-related pain in the pediatric emergency department.

Methods

The study was conducted as a parallel-group, randomized controlled design. The study population consisted of 159 children aged 7 to 10 years cared for in the emergency department who received an intramuscular injection of ampicillin/sulbactam. The children were randomly assigned to Palm Stimulator, ShotBlocker, or control groups. The children's preprocedure fear levels were evaluated using the Children's Fear Scale, and their perceived pain levels during the procedure were evaluated using the Faces Pain Scale-Revised and Visual Analog Scale. Parents and observers also completed the pain level scores.

Results

According to all raters (child, parent, and observer), the Palm Stimulator group had the lowest mean Faces Pain Scale-Revised score averages (P <.001). The Visual Analog Scale score averages of the children in the Palm Stimulator group (Visual Analog Scale: M = 27.94, standard deviation = 19.13) were statistically significantly lower than the ShotBlocker (Visual Analog Scale: M = 46.07, standard deviation = 24.96) and control group (Visual Analog Scale: M = 53.43, standard deviation = 29.01) score averages (F = 14.94, η2 = 0.16, P = .001).

Discussion

The results of this study support the effectiveness of the Palm Stimulator to reduce perceived pain in children during intramuscular injection administration in the pediatric emergency department.

FULL TEXT

Contribution to Emergency Nursing Practice

••Several nonpharmacologic methods are used for reducing pain and fear of pediatric patients during intramuscular

injection in the pediatric emergency department.

••The present study provides unique information about an innovative nonpharmacologic pain-reducing Palm Stimulator device tested during intramuscular injection for children in the emergency department.

••The results of this study support the efficacy of the Palm Stimulator device to reduce intramuscular injection needle–related pain for children in the emergency department setting.

Introduction

Many health care applications, especially intramuscular (IM) injection applications, cause pain, anxiety, and fear in pediatric emergency department patients.[1-3] The American Academy of Pediatrics states that children should not be subjected to painful medical interventions and that every effort should be made to reduce the pain that children may experience because of these health care interventions.[4] It is important to reduce perceived pain during painful procedures because pain experienced in childhood can affect the pain response to future events.[3,5]

Pharmacological and nonpharmacological methods may be used together to reduce injection-related pain in children.[6] Nonpharmacological methods used in pain management can be divided into 3 groups: supportive, cognitive/behavioral, and physical.[7] One of the physical interventions designed to reduce injection pain in children is called ShotBlocker. It was designed in accordance with the principles of the Gate Control Theory.[8] According to the theory, providing a physical stimulus, such as a massage or vibration, to the skin at the injection site prevents the transmission of pain by closing the pain gate in the spinal cord.[9,10] ShotBlocker (Bionix, USA) creates a stimulus at the injection site to close the pain gate in the spinal cord in order to reduce the perceived injection pain.[10-13]

Palm Stimulator, developed by researchers for reducing perceived pain during IM injections in children, was also designed in accordance with the principles of the Gate Control Theory.[8] Although a tactile stimulus physically placed in the palm can have a similar expected mechanism of action as ShotBlocker, Palm Stimulator is based on the use of a more sensitive body part in transmitting a potentially stronger stimulus according to the somatosensory map and prevailing theory.[14-16]

Different studies have evaluated the effect of creating a physical stimulus on the skin during painful medical interventions to reduce perceived pain. For this purpose, the Buzzy (MMJ Labs, Atlanta, GA, USA)[17,18] or ShotBlocker[8,11-13,19,20] devices are well studied in the field, as are methods of human touch or applying manual pressure.[21-23] In considering ShotBlocker-related studies, whereas some studies have reported that this intervention had no effect on reducing perceived pain,[10,24] others report that it is an effective method for reducing the perceived pain experienced during injection.[8,11-13,19,20,25]

There are several studies evaluating the effect of squeezing a soft ball in the palm of children's hands in reducing pain experienced during painful procedures.[26,27] These studies have used the ball as a distraction instead of creating a stimulus in the palm of the hand, with soft balls preferred for this purpose. However, there are currently no studies that evaluate the effect of a device creating a stimulus in the palm of the hand, as ShotBlocker is intended to accomplish near the injection site, in reducing perceived pain.

It is important that effective-appropriate and ineffective-inappropriate perceived pain reducing intervention strategies are evidence-based.[2] In this regard, it is important to conduct well-designed studies that compare various nonpharmacological methods among children of different age groups in addition to studying their effectiveness in pain management. The aim of this study is to evaluate the effect of ShotBlocker and the Palm Stimulator for reducing pain associated with the administration of IM injection in pediatric emergency department.

This study has 3 hypotheses as follows:

H_1. The application of the Palm Stimulator method reduces the perceived pain levels of children during the IM injection.

H_2. The application of the ShotBlocker method reduces the perceived pain level of children during the IM injection.

H_3. The effects of the Palm Stimulator and ShotBlocker methods on children's levels of perceived pain during the IM injection differ.

Methods Study Design and Setting

The study was conducted using a randomized controlled research design. A parallel trial design was used describing 2 different experimental groups (Palm Stimulator and ShotBlocker) and a control group (no intervention used) as the third arm. This study was guided by the Consolidated Standards of Reporting Trials guidelines and checklist.[28] The single-site study took place in a state hospital located in the eastern part of Turkey between February 2019 and July 2109. The majority of patients in this setting were ethnically Turkish and Kurdish.

Population

The study population consisted of children in the 7-10 age group receiving care in the emergency department. The study sample was composed of children admitted to an emergency department during the dates of the study undergoing nurse-administered IM injection of the ampicillin/sulbactam group of antibiotics as part of their usual medical treatment prescribed by the physicians. Ampicillin/sulbactam group antibiotics were selected as they cause less drug-related pain compared with some other antibiotics such as penicillin. In addition, this group of drugs was frequently administered in the emergency department. Therefore, children preparing for treatment with ampicillin/sulbactam group antibiotics constituted the source study population. The study included children who (1) had no diagnosed physical or mental disability or chronic illness; (2) had no communication problems; (3) received a single injection, (4) required ampicillin/sulbactam group of antibiotics for standardization, and (5) received ventrogluteal muscle injection during the study. Parents who were unable to collaborate in the fear and pain evaluation, children who were overweight or underweight (under the third or above the 97th percentile), children with any incision or scar tissue in the injection area, and children who received a sedative, analgesic, or narcotic drugs 6 hours before the procedure on the basis of parental statements and medical history were excluded from the research. Expert opinion was obtained from a professional in the field of pharmacology in determining that receiving a sedative, analgesic, or narcotic drugs 6 hours before the procedure constituted justified exclusion criteria. The use of these sedative, analgesic, or narcotic drugs was checked on the patient chart and confirmed by the parents.

Sample Size Estimation and Randomization

The G*Power (v3.1.9; Heinrich-Heine-University, Düsseldorf, Germany) program was used to determine the sample size, and the sample number was determined to be 53 for each group, with a 0.95 effect size,[12] 0.95 representative power, and 0.05 type-1 error margin. The decision was made to add 3 additional children (a 5% increase) to each group (Palm Stimulator: 56, ShotBlocker: 56, Control: 56), considering that there will be losses in the groups.

In this study, the assignment of participants to the control and experimental groups was performed using the stratification and block randomization methods by the researcher. The age, sex, and fear of children can affect procedural pain and anxiety.[29-31] In the study, the children were stratified and blocked according to age (7-8 and 9-10 years old), sex (male or female), and fear of the injection procedure (afraid and not afraid). By ensuring that the strata formed according to the specified variables was repeated 7 times, 56 children were included in each group (2 × 2 × 2 × 7). The research groups were written on separate papers, folded, and drawn randomly to determine the assigned group of each child during the data collection phase. Thus, the number of individuals in the groups was evenly distributed, with equal probability of assigning each child participating in the study to any one of the intervention groups or the control group. This random assignment process was continued until there were 56

participants in each group. Because of the nature of the intervention, double-blinding was not possible in this study.

Data Collection

In the study, only the pain associated with the injection administration was assessed. The study data were collected by the researcher in the pediatric emergency department using the child-parent information form, Children's Fear Scale (CFS), Faces Pain Scale-Revised (FPS-R), and Visual Analog Scale (VAS) via face-to-face interviews lasting 25 minutes in duration on average. Separate evaluations were provided by the children themselves, their parents, and an independent observer using data collection tools.

Child-Parent Information Form

The standard information form, which was developed by the researcher and consists of a total of 12 items, 8 of which include the descriptive characteristics of the children (eg, age, sex, weight, height, hospitalization unit, etc.) and 4 of which include the sociodemographic characteristics of the parents (eg, age, sex, educational level, socioeconomic status), was collected from all children and parents involved in the study.

Children's Fear Scale

The CFS is a scale used to assess the level of anxiety in children. The scale is a visual measurement tool with scores ranging from 0 to 4 points. It consists of 5 facial expressions, ranging from a neutral to a frightened expression, and is suitable for use with children aged 5 to 10 years.[32-34] The evaluation of the Turkish psychometric properties of the scale, which was developed by McMurtry et al[32] for pediatric patients, was conducted by Özalp Gerçeker et al,[33] and the scale was translated into the Turkish language. The CFS has demonstrated good evidence of test-retest (r_s = 0.76, P r$_s$ = 0.51, P r$_s$ = 0.73, P 33

Faces Pain Scale - Revised

The FPS-R is a scale used to assess the level of pain in children in the 4-to-12 age group.[35] There are facial expressions that show the increasing levels of pain severity from left to right in the scale. Rated according to the severity of pain (between 0-10 points), the leftmost face refers to "no pain," and the rightmost face refers to "too much pain," comprising a total of 6 facial expressions. The faces exhibit an increase in pain severity to correspond with the scores 0, 2, 4, 6, 8, and 10 from left to right, respectively.[18] In school-aged children, the FPS-R is felt to be the most valid and reliable measure of acute pain, and it was used in more than 140 studies.[18,25,35,36]

Visual Analog Scale

The VAS consists of a horizontal or vertical ruler 10 cm in length, with the phrase "no pain" on one end and "the worst pain imaginable" on the other. The child is asked to mark the point on this line that most accurately reflects his/her pain. The distance between the child's mark and the left end of the scale is measured in cm and recorded as points. It has been suggested that the widely researched scale should be used for children aged ≥ 7 years.[13,25] It was reported that the VAS is a useful and valid tool for pain and anxiety assessment in routine clinical practice. The validity of VAS was established in a study of acute pain.[37,38]

Interventions Palm Stimulator

The Palm Stimulator was created by the present researchers/authors of the study. The device is 1.6 cm in diameter, 4 cm in length, and has a cylindrical, nonslippery structure for an easy grip to ensure maximum contact with the palm ([Figure 1]). The national patent application for the apparatus developed by the researchers was filed with the Turkish Patent and Trademark Authority with the number 2018/06479, and the Patent Cooperation Treaty (PCT) application was filed with World Intellectual Property Organization with the number PCT/TR2018/000089. The Palm Stimulator consists of firm and blunt protrusions that provide a tactile stimulus on the palm. The blunt protrusions do not penetrate into the skin. The simulator design is based on the Gate Control Theory, which allows for a reduction in the perceived amount of pain experienced during injection by closing the pain gate in the spinal cord in creating a

stimulus on the skin.

ShotBlocker

The ShotBlocker features short, blunt protrusions on one side touching the skin and has a hole in the middle that exposes the injection site (Figure 2). ShotBlocker's mechanism of action is that the pressure the blunt protrusions exert on the skin stimulates faster nerve cells (in terms of their traveling speed) that are smaller in diameter. This stimulus temporarily blocks pain signals by closing the gates to the central nervous system and thus reducing the amount of perceived pain experienced during injection.[11,24,25]

Procedure

The injection was administered by the same volunteer clinical nurse to all children involved in the study. The clinical nurse is a nurse who has completed training at the undergraduate level and has had 8 years of professional experience, including 4 years in pediatric departments. All injections were administered using 22 Gauge and 0.70 ×32 mm needle tips. Injection volumes were between 1.5 mL and 2.0 mL for each child.

A pediatrician made the clinical decision for IM injection as a part of necessary medical care of the pediatric patients. This decision was not influenced by the study procedures and only constituted the trigger for recruitment and defined the source sample population. All child and parent participants in the study were informed about the research and were told that they would be in one of the 3 groups. First, the Children-Parent Information Form was administered to all participants by the researcher. Second, the children's preprocedure fear levels were assessed 1 minute before the injection by the child, parent, and an independent observer through CFS. Then, the process steps were applied on the basis of the children's study group assignment. Finally, the perceived pain levels were measured by the children themselves (using both VAS and FPS-R), their parents (using FPS-R), and an independent observer (using FPS-R). The independent observer had completed undergraduate education in the field of nursing and worked as a nurse at the hospital where the study was conducted. She was trained by the researcher to assess the children's fear and pain levels. The independent observer was not involved in the creation of the Palm Stimulator and was not the author of this study. The observer volunteered to evaluate the fear and pain of the children. No blinding occurred in this study.

The Palm Stimulator Group

Children in the Palm Stimulator group were shown the Palm Stimulator, which provides a tactile stimulus, by the researcher before the injection process, to allow the child to become familiarized with the device. The Palm Stimulator was placed in the palm of the child's dominant hand 20 seconds before the injection. The researcher ensured that the apparatus was held tightly in the child's palm throughout the procedure. The device was retrieved from the child after completing the injection process. After each application, the Palm Stimulator was disinfected and then reused.

The ShotBlocker Group

Children in the ShotBlocker group were shown the ShotBlocker by the researcher before the injection process to allow them to examine it. ShotBlocker was placed in the ventrogluteal area 20 seconds before injection. It was fixed at the injection site until the injection process was completed. After completing the injection process, it was disinfected and reused.

The Control Group

In order to prevent the children in the control group from being influenced, they were separated from the intervention groups, and the application was performed so that the children could not see each other. The routine IM injection (ventrogluteal area in the prone position) was applied to the children in the control group.

The children were evaluated for their pain levels 1 minute after the injection using VAS and FPS-R. For each child, a

parent and an independent observer assessed their pain levels during the procedure 1 minute after the injection using the FPS-R.

Ethical Consideration

Ethics committee approval was obtained from the İnönü University Clinical Research Ethics Committee (Protocol 2018/146). The purpose of the study was explained to the children and their parents who met the research inclusion criteria. Then the children and their parents were informed about the method of the study, and the volunteers were included in the study. Participants were informed about the procedure of the study before participation and that they could withdraw from the study at any time without explanation. Written informed consent was obtained from all parents, and verbal assent was obtained from all children by researchers.

Data Analysis

The study data were analyzed with the SPSS 21.0 program (IBM Corp, Armonk, NY). Shapiro–Wilk test was implemented to determine whether the sample data were normally distributed, and it was determined that all data were normally distributed. Descriptive statistics (mean, median, interquartile range, percentage, standard deviation) and comparative statistics (analysis of variance, Pearson chi-square tests) were used for the evaluation of the data. Comparisons of pediatric procedural fear (CFS scores) and pain (FPS-R scores) for the 3 groups were conducted using analysis of variance, and the post hoc advanced analysis Tukey HSD for binary comparisons were used for the statistical analyses. The intraclass correlation coefficient was used to evaluate the correlation between IM injection pain and the fear scores among children, parents, and the observer. A partial- η^2 coefficient was used to calculate the effect size. According to the literature,[39,40] the η^2 value was considered small if $0.01 \leq \eta^2$ 2 2 ≥ 0.14. The research findings were evaluated at a 95% confidence interval (CI) and a significance level of *P* **Results**

In the present study, 224 children were assessed for eligibility, and 168 children who met the inclusion criteria were randomized as 56 individuals in each group (Figure 3). The median age of the children was 8 (7-10) years. In the study, there was no statistical difference between the groups in terms of sex, age, weight, height, parental age, parental education status, family socioeconomic status (*P* > .05, Table 1).

Table 2 shows the consistency between the measurements by the children, parents, and observer. According to the evaluation conducted by the children, parents, and the observer, the difference in the CFS score averages between the children in the control and experimental groups was not statistically significant (*P* > .05, Table 3; Figure 4A).

A comparison of the FPS-R score averages of the children in the Palm Stimulator, ShotBlocker, and control groups according to the evaluations of the children, parents, and observer is given in Table 4 and Figure 4B. Overall for all 3 treatment arms, the 95% CI for the FPS-R scores of the children was 3.79-4.70, parents was 4.36-5.31, and observer was 3.99-4.88. The difference between the 3 treatment groups was statistically significant in terms of the perceived pain levels of the children evaluated via the statements of the children. According to post hoc analysis, the difference between the groups was due to the Palm Stimulator group. According to the FPS-R pain score averages, the η^2 values for all 3 assessments were 0.143 (large effect size) for the children, 0.120 (moderate effect size) for the parents, and 0.155 (large effect size) for the observer.

The 95% CI for the VAS score averages for all 3 treatment groups combined was 38.28-46.68. There was a statistically significant difference between the groups in terms of their VAS score averages. The VAS score averages of the children in the Palm Stimulator group (VAS: M = 27.94, Standard deviation [SD] = 19.13) were statistically significantly lower than the ShotBlocker (VAS: M = 46.07, SD = 24.96) and control group (VAS: M = 53.43, SD = 29.01) score averages (F = 14.942, *P* = .001). The fact that η^2 = 0.16, according to the VAS score assessment of the children, indicates a large effect size (Table 4).

Discussion

The present study was conducted to determine the effect of the Palm Stimulator and ShotBlocker methods on the reduction of perceived pain during the administration of IM injection in pediatric emergency department. The Palm Stimulator demonstrated effectiveness in reducing perceived pain in children. Although the perceived pain levels of the children in the ShotBlocker group were lower than those of the control group, this difference was not statistically significant.

Variables such as child age, sex, and developmental level are considered among the biological factors that affect pain perception and response.[29-31] In the study, there was no difference between the groups in terms of age, sex, location, and parental educational level. Thus, we have increased confidence our findings were due to the intervention and not the patient's characteristics. In other studies aiming for similar reductions in pain, the effects of interventions have been evaluated by controlling for certain features of the study groups, including their sociodemographic characteristics.[19,20,31,41] In the present study, the factors that may have affected the perceived pain levels of the children were found to be homogeneous between the control and experimental groups. Thus, the influence possibility of these variables was reduced when evaluating the effect of the Palm Stimulator and ShotBlocker methods in reducing perceived pain.

High levels of anxiety and fear experienced during painful medical interventions can increase the amount of perceived pain.[32,42] In our present study, the difference in the preprocedure CFS score averages between the children in the groups was not significant according to the evaluations conducted by the children, parents, and observer. This was an important finding as a way to address the potential confounding influence of fear, because children's level of fear and anxiety experienced before a procedure can affect the level of pain experienced during the procedure.

It is important to include parents in the assessment process for the more accurate pain assessment and effective pain management of children.[43] In this study, there was a high correlation between the pain score averages assessed by the children, parents, and observer ([Table 2]). The high degree of consistency between the measurements in the groups indicates the consistency of the evaluations.

The Palm Stimulator group in our study was the only group with statistically significant decreases in perceived pain levels of the children according to the FPS-R and VAS scores of the evaluators. Restated, our hypotheses were as follows: (1) the application of the Palm Stimulator method reduces the perceived pain levels of children during the IM injection, (2) the application of the ShotBlocker method reduces the perceived pain level of children during the IM injection, and (3) the effects of the Palm Stimulator and ShotBlocker methods on children's levels of perceived pain during the IM injection differ. Our first and third hypotheses were confirmed, whereas our second hypothesis was rejected. The results of other studies, which indicate that the use of the ShotBlocker has no significant effect on reducing injection-related pain in children, also support the findings of our research.[10,24] Given that the Palm Stimulator is a novel device, there is no other literature yet to support or refute our current findings related to this device.

The palm, compared with other body parts, is over-represented in the somatosensory cortex and is more sensitive to transmitting stimuli.[14-16] Several studies have evaluated the effect of stimulus applied to the palms for reducing perceived pain due to invasive interventions.[27,44] The interventions in these studies use a soft ball or hand tactile stimulus technique to divert attention by using palms, but no tactile stimulus creation technique was found in similar studies that uses any device or apparatus as ours does. In the study of Safari et al,[44] a stimulus was provided by touching and stroking the palm for 5 minutes during painful invasive interventions in school-age children. Providing tactile stimulus to the palm was effective in reducing perceived pain in children. Similarly, Sadeghi et al.[27] determined that squeezing a soft ball was an effective and usable method for reducing perceived pain. Although the

results of these previous studies are similar to the findings of our study, the Palm Stimulator used in the present study was novel and created by researchers of the study. It was developed as a nonpharmacological pain reduction method in children for ease of use, ease of disinfection, reusability, and complication-free or anticipated harm-free properties.

We recommend replication of our intervention study by other research teams in other settings. For study replication for teams with limited statistics support, a minimum total sample size of 159 is recommended on the basis of our results for estimated power of .95, type-1 error margin of 0.5, and large effect size of .399.[39] Research teams are encouraged to calculate a project-specific estimated sample size justification based on variability and population heterogeneity at their data collection sites, additional variables to be tested, and desired effect size detection as their resources allow.

Limitations of the Study

This study had several limitations. First of all, although a homogeneous sample increases internal validity, it may raise questions about the generalizability of these findings to children of different ethnicities and ages. Second, because of the nature of the intervention, double-blinding was not possible in this study. To reduce this limitation, the children were randomly assigned to the groups. A major limitation of the study is that the researchers/authors of this study are also the creators of the device. To mitigate potential bias of researchers/creators bias, study was conducted as a randomized controlled study design, and pain and fear scores were obtained from the children, their parents, and an independent observer. Data collectors and injection proceduralists had no relation to the developed device and were only trained by the researchers to assess fear and pain levels. The researchers who created the device did not assess the children's levels of fear and pain, but data collection, data entry, and data analysis process were conducted by the researchers/authors of the study. Thus, the potential for bias in the design and/or writing of the results is still present. Although the protocol was publicly preregistered before publication of the results, it was deposited after the study data collection was complete. Future work would be improved by registering the trial before data collection. It is important to replicate the results in a multicenter setting where the developers of Palm Stimulator are uninvolved in implementation and data collection.

Implications for Emergency Clinical Care

Pediatric emergency nurses work in a fast-paced environment, but they must be aware of the fear and pain associated with the IM injection procedure. Hospital policies should support the combined use of pharmacological and nonpharmacological methods to reduce injection-related pain in children. There is evidence to support the effectiveness of several nonpharmacologic methods to decrease pain and distress in the Emergency Nurses Association's Clinical Practice Guideline.[3] Our study advances the evidence associated with this guideline using randomized control trial methods and a novel nonpharmacological device. The present study provides unique information about an innovative pain-reducing method to be used during IM injection in children in the emergency department. As a practical method, our results support that the Palm Stimulator reduces pain caused by IM injection among pediatric emergency department patients.

It is important to provide training to health care providers, especially pediatric emergency nurses, and increase their ability to effectively use pain-reducing methods such as Palm Stimulator during needle-related procedures. Further studies are needed to evaluate the effect of the apparatus on pain reduction during other needle-related interventions such as blood sampling, intravenous catheterization, or subcutaneous injections.

Conclusion

The Palm Stimulator, which was created by the researchers, was effective in reducing perceived pain in children during the administration of an IM injection. Although the perceived pain levels of the children in the ShotBlocker

group were lower than the control group, this difference was not statistically significant.

This research contributes to the scientific literature by presenting an innovative pain-reducing method to be used during IM injection in children. We recommend further use and research on the Palm Stimulator apparatus as a practical and innovative nonpharmacological intervention for reducing perceived pain caused by IM injections in children treated in the emergency department.

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Author Disclosures

Conflict of interest: none to report.

Clinical trial number: NCT04594083.

The authors of the study created the Palm Stimulator device and have filed for a patent under the Turkish Patent and Trademark Authority with the number 2018/06479, and the World Intellectual Property Organization with the number PCT/TR2018/000089. The authors did not administer the injection, directly deliver the study procedures with patients, or collect the data presented here. The authors disclose no other conflicts of interest in the study between the device creator, the authors, the independent observer, and the nurse who administered the injections. No external funding was provided in the development of the device or in the patent application process.

Variables	Palm Stimulator group (n = 53)		ShotBlocker group (n = 53)		Control group (n = 53)		Test values	P
$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	F/χ^2	Age (y)	8.45
1.11	8.50	1.18	8.52	1.21	0.06*	.94	Weight (kg)	28.09
7.71	28.41	6.97	29.60	9.19	0.52*	.59	Height (cm)	128.71
11.37	128.86	9.95	130.71	10.81	0.57*	.57	Body mass index	16.72

2.78	16.92	2.59	16.96	3.39	0.10*	.90	Parental age	38.18

Groups	CFS*		FPS-R	
ICC*	P	ICC	P	Palm stimulator
0.928	<.001	0.946	<.001	ShotBlocker
0.938	<.001	0.934	<.001	Control

Evaluated	95% CI for CFS Score, all groups (n = 159)*	Palm Stimulator group (n = 53)	SD	Shot Blocker group (n = 53)	SD	Control group (n = 53)	SD	Test Values	P
$\bar{x}$	$\bar{x}$	$\bar{x}$	F	Child-reported	1.79 - 2.27	2.00	1.58	2.05	1.51
2.03	1.51	0.02†	.98	Parent-reported	1.60 - 2.05	1.81	1.37	1.79	1.45
1.88	1.50	0.06†	.94	Observer-reported	1.54 - 1.96	1.64	1.27	1.77	1.35

Evaluated	All groups combined, 95% CI for score, n =159‡‡		Palm Stimulator* (n = 53)		Shot Blocker† (n = 53)		Control‡(n = 53)		Test values	P	Eta-square (η^2)
$\bar{x}$	SD		$\bar{x}$	SD	$\bar{x}$	SD	F	Child-reported§	3.79-4.70	2.79¶	2.39
4.52	2.69		5.43	2.99	13.034‖	<.001 *<‡	0.143	Parent-reported#	4.36-5.31	3.47¶	2.51
5.05	2.97		6.00	3.03	10.627‖	<.001 *<‡	0.120	Observer-reported**	3.99-4.88	3.01¶	2.34
4.56	2.55		5.73	2.93	14.321‖	<.001 *<‡	0.155	F		4.843††	
3.718††			3.731††					P	.01		.03
.03					§<#		**<#		§<#		
			VAS score (child-reported)	38.28-46.68	27.94	¶19.13	46.07	24.96	53.43	29.01	14.94‖

DETAILS

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Multimodal Quality Improvement Intervention With Dedicated Patient Flow Manager to Reduce Emergency Department Length of Stay and Occupancy: Interrupted Time Series Analysis: JEN

ABSTRACT (ENGLISH)

Introduction

Crowding in the emergency department is a problem worldwide that can affect patient safety and clinical outcomes. The aim of this project was to evaluate a multimodal quality improvement intervention with a new patient flow manager to reduce ED length of stay and ED bed occupancy.

Methods

This single-site interrupted time-series analysis study was conducted in a tertiary hospital emergency department in South Korea. Interventions for a novel system load-balancing approach included a data-driven patient flow tracking informatics system, adding medical specialists, point-of-care creatinine testing (when required before diagnostic imaging) with dedicated imaging test slots for emergency patients, and introducing patient flow managers. Records of adult patients visiting the emergency department from January 2016 to March 2020 were included. Outcomes were ED length of stay and ED bed occupancy. Regression discontinuity analysis of an interrupted time series was used adjusting for seasonality and the number of patients per staff.

Results

A total of 46,494 patients in the preintervention period and 151,802 patients in the postintervention period were included. After the intervention, ED length of stay decreased by 4.07 hours, whereas the slope indicated a return to preintervention levels over time. Monthly average ED bed occupancy decreased by 34.6%, and the slope remained consistent over time.

Discussion

The multimodal quality improvement intervention that included a patient flow manager was an effective intervention to reduce the ED length of stay and the ED bed occupancy at the study site. The change for length of stay may not sustain over time without further intervention.

FULL TEXT

Contribution to Emergency Nursing Practice

••Crowding in the emergency department is a problem worldwide and can affect patient safety and clinical outcomes. Crowding is a complex issue with a variety of contributing factors: input, throughput, and output factors. Interventions to address input and throughput factors are only successful if departments also address the outflow of

patients from the emergency department.

••A multimodal system load-balancing approach quality improvement intervention that includes a patient flow manager can reduce length of stay and occupancy in the emergency department.

••Reductions in ED length of stay may not sustain over time without additional intervention.

Introduction

Crowding in the emergency department is a problem worldwide and can affect patient safety and clinical outcomes.[1-7] Crowding is a complex issue with a variety of contributing factors. Asplin et al[8] developed an ED crowding model that classified contributing factors with input-throughput-output components and stressed the need for a systems approach to solve ED crowding.

Available Knowledge

Some studies reported that ED crowding could be reduced by using a method that addresses input factors, such as case management for ED frequent users or crowd informing to balance the patient loads among emergency departments.[9,10] However, it is difficult to control most input factors such as patient complexity and referral from other hospitals at the hospital level. To increase ED throughput, hospitals have invested in additional resources and implemented changes in the care process. However, investing in additional resources is costly and is only partially effective. In particular, studies have found that additional staffing can be effective, but expanding treatment areas is not as effective.[11,12] Therefore, most current interventions and strategies address care process changes to facilitate patient flow. Although strategies to facilitate patient flow reduced the ED length of stay (LOS) of discharged patients, they did not reduce the ED LOS of admitted patients.[13] These results indicate that interventions targeted at the arrival and evaluation phase are only successful if departments also address the outflow of patients from the emergency department.[3,7,14]

Interventions to resolve the output bottlenecks or blockage include establishing an independent emergency ward and increasing the availability of inpatient beds. The operation of an emergency ward with short turnaround times could reduce the ED LOS of admitted patients.[3] To increase the availability of inpatient beds, numerous hospital-level interventions are needed such as early discharge times, sharing information about empty beds in real time, and increasing bed allocation for ED patients.[6,15,16] For these interventions to be successfully conducted, it is also essential to garner leadership support and cooperation from other departments. However, gaining such support can be difficult, especially when there is an insufficient number of inpatient beds.[15,17] For addressing ED output bottlenecks in such cases, expanding inpatient bed availability by using other hospitals (ie, transferring patients to other hospitals) can be effective as a system load-balancing approach.[18,19]

Local Problem

Because our setting was one of the most crowded emergency departments in Korea for many years, we implemented various interventions to address the crowding: operating an independent emergency ward and emergency intensive care unit (EICU), point-of-care testing (POCT) laboratory, critical pathways to provide standardized care, operating specific patient care areas (eg, minor patients, trauma patients), digital signage to show the waiting list and treatment progress, and diverting emergency medical services (EMS) when the emergency department was full. Despite these interventions, crowding did not improve.

In 2016, new hospital leadership and ED leadership were appointed, who decided that a comprehensive process innovation was needed to address ED crowding. We have begun to investigate all structures and processes that may affect ED crowding. In terms of structure, we did not have a dedicated laboratory, pharmacy service, case

manager, or social worker for the emergency room. During the process analysis, we recognized that the existing data were insufficient for detailed process analysis and identified that radiology test turnaround was often delayed. We compared each patient's ED LOS. The ED LOS of admitted patients was the longest, whereas the ED LOS of psychiatric patients was not a priority concern or problem, unlike other countries.[20] The number of psychiatric beds per 1000 population in Korea is 1.25 beds, far exceeding the World Health Organization's recommended level (1 bed per 1000), creating sufficient availability and inpatient capacity to ease the transfer of psychiatric patients out of the emergency department. Here, initial improvement targets included developing a novel informatics tracking system, reducing time to radiologic tests, and reducing boarding time for admitted patients.

Aim

We assumed that a multimodal quality improvement intervention addressing the entire ED throughput and output process was needed. In this study, we aimed to evaluate the effect of the multimodal quality improvement intervention with a new patient flow manager to reduce ED LOS and ED bed occupancy.

Methods Study Design and Setting

This quality improvement study was a single-site regression discontinuity analysis of an interrupted time series. The preintervention period was from January to December 2016, and the implementation period was from January to March 2017. The postintervention period was from April 2017 to March 2020.

The study institution was a tertiary regional emergency medical center in the Northwestern area of Seoul, South Korea. It is a level-1 center with approximately 70 000 patients annually (adults, 50 000; pediatric, 20 000). Before the intervention, ED space was 1502 m^2 with 3 care zones including a resuscitation area, a treatment area, and an observation area. The total number of hospital beds (1778 beds) did not change during our study period. Inpatient beds are grouped into specialized units, which rarely admitted overflow patients from other departments, and bed assignments were partially centralized.

All medical departmental specialists were available 24 hours a day, 7 days a week in the emergency department. The emergency ward and EICU were included in the emergency center, and adult and pediatric emergency departments are separate. Medical equipment such as simple X-ray and ultrasound remained unchanged during our study period. The computed tomography (CT) operation method was changed during the intervention period. At first, 2 CT machines were shared with outpatient department patients, but from November 2017, only 1 unit was operated exclusively for ED patients and 1 unit was changed to operate only for outpatient department patients. The ED endoscopy room operated from 9 am to 5 pm, but in March 2019, it was discontinued. The total number of nurses, nurse assistants, and other health care personnel in the emergency department also did not change.

Participants

Study participants were patients who visited the adult emergency department from January 2016 to March 2020. The exclusion criteria were patients who cancel the registration due to nonemergency condition. Here, if a patient visits the emergency room with a nonemergency clinical presentation, the provider may perform a simple examination and cancel the emergency registration. In this case, we could not obtain the patients' data, so they were excluded.

Ethical Approval

This study was approved by the institutional review board (H-1803-011-925), and all data were stored in a deidentified form.

Intervention

The ED leadership began exploring several interventions with the ED operation committee as follows:

Developing a Patient Flow Tracking Informatics System

Before the intervention, only data on entrance time, initial blood test result report time, radiology test result report time, and discharge time were included in the initial clinical data warehouse, so we could not verify the exact patient flow. Thus, data were added to track the time of events such as triage and time to physician evaluation in November 2016. In addition, it was recognized that real time of disposition-decision time and consultation reply did not match the time clinicians were saving in the medical record, and we developed a new disposition-decision time and reply time input program in June 2017. The new patient flow tracking informatics system could show the amount of time spent for each event in detail.

Setting a Target Time for Each Event With Feedback

A benchmark target time was set for each event and reviewed 3 times a week in the operations meeting. The goal was for each patient to leave the emergency department within 12 hours. If a consultation was needed, the consultant should have evaluated the patients within 3 hours, and disposition should have been decided within 6 hours. The target compliance level was reported monthly to hospital leadership and fed back to each department. If an outlier was observed, the cause was analyzed and addressed. The time to CT was set for 1 hour from prescription to test and magnetic resonance imaging (MRI) for 2 hours.

Changes in Medical Staffing and Physical Treatment Areas

Before the intervention, Korean triage and acuity scale (KTAS) levels 3 to 5 patients were evaluated by emergency residents, level 2 by an emergency specialist, and level 1 by the emergency medical director. After completing the initial evaluation, patients were referred to the attending resident of internal medicine, neurology, or orthopedic, as needed. After the intervention, some of the level 3 to 5 patients were evaluated by an emergency specialist for a quick treatment decision. After completing the initial evaluation, if needed, patients were referred to the attending specialist of each department. The average number of emergency specialists increased from 11.2 to 15.4 full time equivalents, and they supported the emergency residents. The allocation of work position to specialists was adjusted based on monthly discussions. The number of nurses did not change. However, the number of working nurses (working pattern) in a day was slightly adjusted according to the workload, but, the change was not adjusted as substantial as physicians' work patterns with extra staff and expertise reallocation by KTAS.

In October 2017, the entire emergency department was expanded to 1675 m^2. The number of ED beds (40 beds) did not change, but the distance between the beds was widened in accordance with the national policy for infection management. Physically, the ambulance triage zone was separated to reduce the triage time, and a critical care zone with emergency physician specialists was added to minimize delay in treatment for ambulance patients.

Prioritizing ED Diagnostic Imaging and the Addition of POCT

Before the intervention, we found CT scans were delayed because of the process and time for checking the serum creatinine level before the CT scan. POCT was added to check the serum creatinine level in the emergency department in November 2017. After discussing the delay in MRIs, the existing MRI slots were carefully divided to increase the number of slots allocated to ED patients from November 2017. We checked the time from imaging prescription to test implementation at the operational committee meetings 3 times a week (Supplementary Figure 1).

Introducing Patient Flow Managers

A new policy was enacted to reduce boarding time for admission, which was the biggest obstacle to the 12-hour target. All patients who needed admission care but could not be assigned an inpatient bed at our facility were scheduled for transfer to another hospital. The ED operation committee decided to assign personnel exclusively for patient flow management to operationalize this new policy. Patient flow managers should be experts in predicting the treatment process and prognosis.[2] In addition, they should have communication skills for coordination and counseling for patients.[21] The committee determined that emergency nurses with more than 5 years of experience

were appropriate for the responsibilities. Three nurses were appointed as the patient flow managers and changed their role without adding nursing staff to the emergency department.

Patient flow managers were responsible for the 12-hour target performance, but there were no established tasks or job description. Therefore, they had to create the detailed roles and strategies for the patient flow. They discussed the issues with nurses in the emergency center, referral center nurses, and nursing managers. These discussions informed all emergency staff of the patient flow manager's role and helped determine the patient flow manager's detailed tasks. ED leadership was extremely supportive and cooperative.

Patient flow managers were responsible for monitoring patients' timelines through the patients' medical records and arranging the transfer (in and out) process. Generally, the ED bed occupancy in our setting was highest from 2 pm to 6 pm and lowest from 12 am to 6 am. In addition, during the night shift, it was rarely possible to transfer patients given the insufficient personnel in other hospitals. Therefore, the patient flow managers' working hours were set from 7 am to 11 pm (day and evening shifts). One nurse per shift started working in the emergency department in March 2017.

If each event was delayed or a patient was over the target time, the patient flow manager would troubleshoot the issues to prevent further delays. If there was a problem they could not address, they alerted the emergency medical director.

Before our quality improvement intervention, when an outside hospital requested a transfer to the study institution, the emergency medical director was in charge of the reply. If resources of other departments were needed for treatment (ie, surgery), they had to contact the other department's physician to confirm acceptance. However, the emergency medical director was also responsible for the treatment of acute ED patients, so the transfer-in procedure was often interrupted. After the intervention, the patient flow manager identified the patient's condition through a transfer hotline and coordinated the transfer-in process independent of the medical director.

Before the intervention, most of the transfers-out were conducted through the referral center nurses who arranged patient transfers of the entire hospital including the emergency department. This referral center was available from 9 am to 6 pm. After the intervention, the patient flow manager was in charge of emergency department patients' transfer-out process. Patient flow managers were trained at the referral center for a week to learn the transfer-out process. The transfer-out process by the patient flow manager differed in several ways from the conventional method by the referral center nurses ([Figure 1]). The patient flow manager could directly contact the other hospital's emergency department to receive a fast and definite acceptance answer through the on-call system, which made a speedy transfer possible.

Patient flow managers attended the operational committee meetings 3 times a week. They shared information about the target compliance rate and reported the emergency department utilization rate, the number of transfers (in and out), and all cases of patients who failed to meet the 12-hour target. Additionally, they discussed the possible and likely causes of failure and solutions.

Measurements

There is no consensus on an operational definition of crowding, and various indicators have been used to measure crowding.[8,22] In this study, the ED LOS and the ED bed occupancy, the most widely accepted measures, were used as the outcome variables.[23] Patient demographics, reason to visit, route of visit, mode of visit, KTAS level, clinical outcomes, and the ED LOS were collected from the research institution's clinical data warehouse.

We checked clinical outcomes of transferred patients at the beginning of the intervention (from May to September 2017). The clinical outcomes were identified by reviewing the medical records 3 months later. If there was no medical record in our hospital after the transfer, we called and asked for the result ([Supplementary Table 1]). Clinical

outcomes were classified into discharge, admission, and transfer. Admission was defined as hospitalization to all inpatient wards and intensive care unit (ICU), including emergency ward and EICU. Discharged patients included patients who left without seeing a physician if they initially registered and met our inclusion criteria. The ED LOS was calculated as the time difference between registration and discharge. After analyzing the overall ED LOS, we compared the LOS of subgroups: admitted, discharged, and transferred patients. The bed occupancy rate was calculated using the bed occupancy index (average LOS × total number of patients × 100/the number of beds × 24 hours), which is also used to evaluate emergency medical institutions in Korea.[24]

Data Analysis

The characteristics of the patients were summarized as percentage, mean, and standard deviation. There were no missing data regarding patients' characteristics and ED LOS. Distribution of patients' characteristics and ED LOS between pre- and postintervention periods was compared using *t* tests for continuous variables and chi-square test for categorical variables, and the difference between 2 periods was presented.

Adjustment for multiple testing was made using Bonferroni correction. The effect of the intervention on monthly average of ED LOS and ED bed occupancy was assessed using regression discontinuity analysis of interrupted time series data.[25] In the analysis, changes in the baseline level and trends between the 2 segments (pre- and postintervention) were estimated after controlling for seasonality and the ED staff to patients ratio (Supplementary Table 2), which was adjusted because the number of patients and ED staff could affect the LOS.[1,7,11] The number of ED staff was calculated monthly by summing up the total working members. For example, if 10 nurses worked the day shift, 15 nurses worked the evening shift, and 10 nurses worked the night shift; the number of staff per day was 35. Residual autocorrelation was assessed by a residual plot, the partial autocorrelation function, and the Breusch-Godfrey test (Supplementary Figure 2). The data were analyzed with the SPSS 22.0 (SPSS Inc., Chicago, IL, USA) and R3.4.0 (The R Foundation for Statistical Computing, Vienna, Austria).

Results Characteristics of Patients

The total number of cases visiting the emergency department during the study period was 208 303, of which 46 494 cases were in the preintervention period and 151 802 cases in the postintervention period. After the intervention, the number of discharges increased by 1.2%. The total number of admissions decreased by 5.0%, but the number of admissions to all of the ICUs in the hospital increased by 0.4% in the same postintervention period. The number of transfers increased by 3.7% (Table 1).

LOS in the Emergency Department

The mean ED LOS was significantly reduced from 9.47 hours in the preintervention period to 5.76 hours after the intervention. Subgroup analysis based on the clinical outcomes showed that the ED LOS of admitted patients decreased the most, followed by transferred patients (Table 2). The regression discontinuity analysis of interrupted time series data revealed that the slope in the preintervention period appeared to slightly decrease (–0.11 hours, $P = .01$). After the intervention, the change in the baseline decreased by 4.07 hours (*P* P Table 3, Figure 2).

Bed Occupancy Rate

The regression discontinuity analysis of interrupted time series data showed that the slope in the preintervention period slightly decreased by 1.46%, but it was not statistically significant ($P = .19$). After the intervention, the change in the baseline decreased by 34.56%, and the slope increased by 1.91%, but it was not statistically significantly different from zero, meaning there was no change observed over time in the postintervention period ($P = .09$).

Diagnostic Imaging Time

Time to CT and MRI is presented in Supplementary Figure 1.

Discussion Lessons Learned

This study showed that our multimodal quality improvement project that included patient flow managers could decrease the ED LOS and ED bed occupancy. Patient flow managers were able to reduce ED LOS through continuous monitoring and troubleshooting using data and transfer of patients in need of admission. Transferring patients to other hospitals when no beds were available was a way to reduce ED crowding and increase the capacity to treat emergency patients by reducing the boarding time.

In Korea, out-of-pocket medical costs are relatively low owing to the national health insurance and ease of access to tertiary hospitals by the general public. Therefore, tertiary hospitals are often preferred by patients, which affects ED crowding. Cha et al[1] reported that only 10 of the 120 levels 1 to 2 emergency departments nationwide were crowded, and severe input was related to crowding. However, the study comparing Pakistan's and the Netherlands' emergency departments indicated that process management is more important than the number of arriving patients and the structure of the hospital. Although Pakistan's emergency departments had more patient visits and sicker patients, the ED LOS in Pakistan was much longer (279 minutes vs 100 minutes) even though there were more staff, ED beds, and inpatient beds.[7] Therefore, the most effective intervention to address ED crowding appears to be facilitating patient flow. Interventions to address patient flow should be a multimodal, hospital-level intervention, not solely an ED-level intervention.

Physical Layout Changes

The study institution created a new critical care area and ambulance (EMS) triage area to facilitate patient flow. Establishing separate areas for patients (ie, dedicated EMS triage area, fast track) in the emergency department has been shown to reduce ED LOS.[5,26,27] In contrast, ED expansion has been shown to increase ED LOS.[12] Thus, functional zoning seems to have a greater impact than expansion on crowding, and our findings provide corroborating evidence to focus on process rather than number of physical treatment bays.

Target Times

The new patient flow tracking informatics system could show the amount of time spent for each event in detail. However, data such as disposition-decision time and consult reply time, which were not automatically saved and had to be entered by physicians, were insufficient. We introduced POCT and discussed with related departments several times to reduce the time to test. CT mostly achieved the target time, whereas MRI did not reach the target time. The introduction of POCT reduced the result reporting time and the time to CT implementation was reduced. However, it is difficult to confirm that this alone reduces the ED LOS because reading time or other factors can affect it.[28]

Specialists

Another component of the multimodal intervention in our project was the addition of specialists. Initial assessments by these attending specialists could avoid replication of work, and disposition decisions could be made more quickly.[6] However, we could not accurately confirm the effect of the additional placement of specialists on the ED stay period because we could not distinguish specialists from all medical staff in the data.

Patient Flow Manager and Interfacility Transfers

A recent study reported that a disposition prediction model using the patient's data could help the physician's disposition decision and reduce boarding time,[29] but only if an inpatient bed was available. In the study institution, occupancy of inpatient beds was close to 90%; less than 20% of inpatient beds were assigned to the ED patients (excluding emergency wards). The hospital leadership had a long history of attempting to solve this problem, but without success. Given this institutional culture of little coordination across departments, a system load-balancing approach such as off-service placement could not be easily adopted.[30] In addition and in the past, physicians at our site in each department had often pragmatically considered the emergency department as a spare ward for their departments and had their patients treated for days in the emergency department. Therefore, ED leadership decided

that all patients who needed admission care but could not be assigned an inpatient bed should be transferred elsewhere. Initially, there was strong resistance from the other medical departments, but the hospital leadership's strong support was the driving force behind this policy.

Patient flow managers monitored patient flow and arranged transfers-out. They were experienced nurses in the emergency specialty, so they could effectively screen patient flow through the electronic medical record system. The system showed the patient list with color coding based on the LOS and whole process in real time. Therefore, they could identify the cause of delay in real time and troubleshoot the problem. Patients were often scared of transfer and thought they were treated as unimportant people. Previous study expressed this psychological state as "slide into insignificance."[31] Therefore, they often refused the transfer-out. To persuade them, staff should explain the purpose of the transfer and be careful not to give the impression of being rushed and to meet the patient and caregiver's expectations and preferences.[32]

Before the intervention, if the patient or caregiver refused the transfer, the arrangement was terminated. The patient flow manager could persuade the patient or caregiver by explaining the patient's condition and necessary treatment in detail. They selected an appropriate hospital that could not only provide the necessary treatment but also meet the patient and caregiver's needs. In addition, they arranged transport personnel, delivered accurate information and medical records, checked for signed consent, and adjusted the follow-up plan to enable continuous treatment.[33,34] Although these efforts are thought to have led to safe transfers of patients, preintervention safety data were not collected, which limits the support for this claim based on our data.

LENGTH OF STAY and Occupancy

After the intervention, the ED LOS was reduced by 4.07 hours and ED bed occupancy rate by 34.6%. Similar to the present study, some studies confirmed that nurse-led patient flow managers named "emergency journey coordinators" or "navigators" reduced the ED LOS through identifying and resolving any delays.[2,35] Other studies reported that the ED LOS was reduced through patient transfers.[18,19] However, there was no study on cases in which both transfers and patient flow managers were implemented.

Through this quality improvement intervention, the overall ED LOS was reduced, but among them, the ED LOS of admitted patients was the most reduced. The ED LOS in the preintervention period in our study was the longest for admitted patients, so transferring patients who needed admission could be effective in reducing ED LOS. Unfortunately, ED LOS increased toward the preintervention level over time in the postintervention period. It is possible that during the first year the efforts of all staff and help from other departments were concentrated, but that staff fatigue gradually accumulated and support from other departments gradually weakened. This finding suggests that to solve ED crowding over the long term, sustainability of the multimodal interventions and with buy-in from all departments must be addressed.

Disposition

After the intervention, the discharge rate increased. This is comparable with a previous study reporting that physicians prescribed fewer admissions and reduced unnecessary hospitalizations to address crowding.[36] Reducing ED crowding allows more patients to use the emergency department, especially severely acute patients. In this study, the annual average number of patients in the emergency department increased from 46 494 to 50 600 and patients who were admitted to ICU increased from 1563 to 1887 over the study period. Two contributing factors may explain this trend. First, because the patient flow manager was responsible for transfer-in, the number of transferred-in patients in critical condition increased. Second, after the intervention, the number of total ICU beds had not changed, but the number of EICU beds increased from 12 to 20 beds in July 2017, and conversely, medical ICU beds declined from 20 to 12 beds. This evidence supports that the ED-exclusive ICU is an effective throughput

measure, like an emergency ward, to address ED patient flow.[3]

Limitations

This study has several limitations. Many factors were not controlled for in our models, such as physical expansion, the difference in working hours between referral center nurses and patient flow managers, and change of facilities in the emergency department. These may have unmeasured effects on the ED LOS. We could not collect all data related to each intervention, so we could not analyze the exact effect of each component of our multimodal intervention.

Despite numerous studies on crowding, research is still needed on ways to better measure ED crowding.[37] ED LOS and ED bed occupancy rate were used as methods to measure ED crowding in this study. Some researchers[20] have argued that the LOS is significantly influenced by outliers and should be presented as a median value. However, given that the outliers influence real crowding, this study used an average value for comparison. Because the number of ED patients varies greatly throughout the day, the bed occupancy rate should be calculated as the number of patients relative to the real-time bed capacity. However, the bed occupancy rate of this study, calculated based on the number per day, has limitations that do not reflect the actual crowding situation well.[22] Although no additional nursing staff was added to take on the role of patient flow manager, physician staffing was added during the intervention period. Thus, an additional cost analysis should be conducted.[6] Although there was no critical incident reported during the interfacility transport period, the clinical outcome of transferred patients and inpatients should be compared to ensure the safety of the transfer intervention. Finally, it is difficult to generalize the results of the study to other hospitals because this study was conducted in a single institution. It may be necessary to modify the interventions to fit the unique needs and characteristics of each hospital.

Implications for Emergency Clinical Care

This study showed that multimodal intervention including patient flow manager could reduce ED LOS and ED occupancy, although ED LOS increased over time. It is necessary to install an informatics tracking system for detailed data to manage ED LOS, and it is important to monitor the flow of patients in real time using it. However, if the occupancy of inpatient beds is high, only interventions targeted at the arrival and evaluation phase cannot reduce ED LOS. In this case, transfer-out of the emergency department to other hospitals can be considered as a way to address the outflow of patients. Managing ED LOS requires strong and continuous support from all hospital departments and leadership.

Conclusions

In the study institution, a multimodal intervention reduced patients' LOS and the bed occupancy rate. Additionally, the number of patients and number of critical patients increased, suggesting improved ED capacity. To maintain such improvements, institutions need to deploy additional personnel with knowledge, communication skills, and coordination skills, along with continuous interest and support from leadership. Further research is also required on total costs of care and the long-term sustainability of the intervention effectiveness.

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Author Disclosures

Conflicts of interest: none to report.

Ethical Approval

This study was approved by the institutional review board (H-1803-011-925), and all data were stored in a form that could not be identified by an individual.

Supplementary Data

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2021.12.001.

Characteristics	Total		Pre- (a)		Implementation (b)		Post (c)		(c)–(a)	
(N = 208 303)		(n = 46 494)		(n = 10 007)		(n = 151 802)		N or Mean	% or SD	n or Mean	% or SD
n or Mean	% or SD	n or Mean	% or SD	Mean difference (95% CI)	t/χ^2 value	P value*	Sex				
					0.27	1.00	Male	99 532	47.8	22 243	47.8
4 873	48.7	72 416	47.7	–0.1 (–0.7 to 0.4)			Female	108 771	52.2	24 251	52.2
5134	51.3	79 386	52.3	0.1 (–0.4 to 0.7)			Age, y	57	18.6	55.73	18.6
56.77	18.5	57.54	18.57	1.8 (1.6-2.0)	18.38	<.001	Reason to visit				
					2.89	.63	Disease	182 930	87.8	40 713	87.6
8842	88.4	133 375	87.9	0.3 (–0.1 to 0.6)			Injury	25 373	12.2	5781	12.4

1165	11.6	18 427	12.1	–0.3 (–0.6 to 0.1)			Route of visit				
					303.99	<.001	Direct	164 208	78.8	36 322	78.1
7792	77.9	120 094	79.1	1.0 (0.6-1.4)			Transfer	30 086	14.4	6288	13.5
1407	14.1	22 391	14.8	1.2 (0.9-1.6)			OPD	14 009	6.7	3884	8.4
808	8.1	9317	6.1	–2.2 (–2.5 to –1.9)			Mode of visit				
					205.10	<.001	Public ambulance	35 835	17.2	7318	15.7
1267	12.7	27 250	18.0	2.2 (1.8-2.6)			Private ambulance	14 746	7.1	3296	7.1
683	6.8	10 767	7.1	0.0 (–0.3 to 0.3)			Private vehicle	156 993	75.4	35 811	77.0
8043	80.4	113 139	74.5	–2.5 (–2.9 to –2.1)			Others	729	0.3	69	0.1
14	0.1	646	0.4	0.3 (0.2-0.3)			KTAS level				

					785.56	<.001	1	4375	2.1	889	1.9
181	1.8	3305	2.2	0.3 (0.1-0.4)			2	25 628	12.3	6368	13.7
1248	12.5	18 012	11.9	–1.8 (–2.2 to –1.5)			3	116 088	55.7	26 263	56.5
5761	57.6	84 064	55.4	–1.1 (–1.6 to –0.6)			4	53 476	25.7	11 980	25.8
2643	26.4	38 853	25.6	–0.2 (–0.6 to 0.3)			5	8736	4.2	994	2.1
174	1.7	7568	5.0	2.9 (2.7 to 3.0)			Outcome				
					1471.87	<.001	Discharge	148 451	71.3	32 764	70.5
6927	69.2	108 760	71.6	1.2 (0.7-1.7)			Transfer	10 741	5.2	1132	2.4
337	3.4	9272	6.1	3.7 (3.5-3.9)			Admission	48 539	23.3	12 510	26.9
2718	27.2	33 311	21.9	–5.0 (–5.4 to –4.5)			Ward	40 976	19.7	10 947	23.5

2381	23.8	27 648	18.2	–5.3 (–5.8 to –4.9)			ICU	7563	3.6	1563	3.4
337	3.4	5663	3.7	0.4 (0.2-0.6)			Death	572	0.3	88	0.2

	Total		Pre- (a)		Implementation (b)		Post (c)		(c)–(a)		
Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean difference (95% CI)	t value	P value*	Overall, h
6.62	8.80	9.47	13.20	6.49	8.84	5.76	6.67	–3.7 (–3.8 to –3.6)	–58.35	<.001	Admitted, h
11.73	12.50	20.06	17.60	12.34	11.86	8.55	7.97	–11.5 (–11.8 to –11.2)	–70.5	<.001	Discharge, h
4.42	5.12	5.14	7.23	3.97	5.34	4.23	4.25	–0.9 (–1.0 to –0.8)	–21.64	<.001	Transfer, h
13.96	13.72	17.68	19.00	10.69	11.84	13.63	12.91	–4.1 (–5.2 to –2.9)	–6.98	<.001	Death, h

Variables		Beta (95% CI)	P value
Length of stay	Slope in preintervention period	–0.11 (–0.20, –0.03)	.01

Step change in postintervention period	–4.07 (–4.91, –3.24)	<.001	Slope change in postintervention period
0.18 (0.09, 0.27)	<.001	Occupancy rate	Slope in preintervention period
–1.46 (–3.61, 0.69)	.19	Step change in postintervention period	–34.56 (–55.46, –13.66)
<.001	Slope change in postintervention period	1.91 (–0.28, 4.10)	.09

Clinical outcome	N (%)
Discharge	558 (76.4)
Hospitalized (long-term care hospital)	20 (2.7)
Revisit to emergency department	29 (4.0)
Admission to study institution	19 (2.6)
Retransfer	9 (1.2)
Death	1 (0.1)
Death	65 (8.9)
d/t pneumonia (age >85)	5 (0.7)
d/t terminal cancer	60 (8.2)

Unknown	58 (8.0)

Characteristics	Total (N = 51 mo)	Pre- (a) (N = 12 mo)	Implementation (b) (N = 3 mo)	Post (c) (N = 36 mo)	(c)–(a)		
Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean difference (95% CI)	t value	P value	ED staff to patient ratio

DETAILS

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Verification of Endotracheal Tube Position by Emergency Nurses Using Ultrasound: A Repeated Measures Cadaver Study: JEN

ProQuest document link

ABSTRACT (ENGLISH)

Introduction

Endotracheal intubation is a lifesaving procedure frequently performed in emergency departments. It is associated with some potential risks. Rapid and reliable confirmation of endotracheal tube placement during intubation is critical. Nurses play an important role in the care of patients in various settings. Ultrasound can be performed and interpreted not only by physicians but also by nurses. The aim of this study was to evaluate how well nurses without previous ultrasound experience can determine both esophageal and tracheal localization of endotracheal tubes in cadavers after a short ultrasound training.

Methods

This was a repeated measures study with an educational intervention and no control/contemporaneous comparison group. The study was performed to evaluate the ability of emergency nurses to confirm correct endotracheal tube

placement and identify esophageal intubations. A total of 7 emergency nurses were given theoretical education and hands-on training about ultrasound. They diagnosed tracheal or esophageal intubation using ultrasound.

Results

Four cadavers were used 8 times each for the study. A total of 32 intubation procedures were evaluated with ultrasound by each nurse. In the analysis based on 224 responses, sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and overall accuracy of ultrasound applied by nurses to detect tracheal intubation were 95.61% (90.06%-98.56%), 97.27% (92.24%-99.43%), 35.06 (11.48-107.10), 0.05 (0.02-0.11), and 96.43% (93.08%-98.45%), respectively. The mean time to evaluate the tube location by ultrasound was 6.57 seconds.

Discussion

The results support that ultrasound can be performed by nurses for the confirmation for esophageal and tracheal intubations quickly and accurately.

FULL TEXT

DETAILS

Subject:	Laboratories; Intubation; Patients; Emergency medical care; Airway management; Educational programs; Cadavers; Artificial respiration; Trauma; Professional training; Neck; Verification; Physicians; Nurses; Emergency services; Esophagus; Localization; Intensive care; Ultrasonic imaging; Statistical analysis
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Commentary on “Burnout and the Sexual Assault Nurse Examiner: Who is Experiencing Burnout and Why?”: JEN

ABSTRACT (ENGLISH)

According to Befus et al9 and Poldon et al,10 the trauma- and violence-informed care approach enhances health equity and improves patient care outcomes. Trauma- and violence-informed nursing care enhances overall support

to the patient to promote postassault healing while also promoting health equity and upholding social justice.9,10 Amaret et al11 note that trauma- and violence-informed training calls for all SANEs to be committed to lifelong learning, having insight and knowledge and personally caring about their patients, including their cultural and social identity. [...]qualitative research can offer the SANE an opportunity to self-reflect and create an opportunity to center the voices of SANEs with narratives and stories, providing insight into vicarious trauma and building nursing knowledge that enables us to address burnout.13 As practicing forensic nurses within the subspeciality of SANE (J.C.R, S.H., K.M.), we live, realize, and acknowledge the emotional toll related to the complex and intense nature of the SANE role.

FULL TEXT

In the paper Burnout and the Sexual Assault Nurse Examiner: Who is Experiencing Burnout and Why? in this edition of the *Journal of Emergency Nursing (JEN),* Zelman et al[1] examine the frequency of burnout and its accompanying features among sexual assault nurse examiners (SANEs) in North Carolina using the Maslach Burnout Inventory scale. The authors' cross-sectional study provides the field of forensic nursing with essential knowledge and contextual understanding of burnout among SANEs working within forensic programs and those working in emergency departments of varying sizes, including some located in rural areas. The knowledge garnered from this study is also valuable for other nursing specialties, particularly in the emergency department and different acute care settings.

Zelman et al[1] share the findings of their study about SANE burnout amid an ongoing coronavirus disease 2019 global pandemic. The work of SANEs has never been more critical, and the support of SANEs by ensuring job satisfaction and retention and minimizing burnout has never been more dire. During this pandemic, scholars and advocates have noted that violence, particularly in the lives of women, has increased exponentially.[2] As a result, the workload of SANEs has increased, with the risk of burnout becoming even more significant.[3] The recent increase in prevalence of violence, compounded by the problem of burnout results in the lack of available SANEs to meet the health care needs of sexual assault survivors.

As a team of diverse scholars working with Indigenous and Black survivors of gender-based violence, including sexual assault, we note that a limitation of the study, as is the case with many studies, is that study implications are not uniquely tailored to speak to the needs of specific populations of women. Although the premise of most studies is not necessarily to center the needs of Black and Indigenous women and women of color (henceforth BIPOC women), it is critical to highlight that BIPOC women experience the highest rates of sexual assault and intimate partner violence.[4-6] In addition, BIPOC women experience the highest rates of homicides, with more than half (55%) being related to instances of intimate partner violence.[6] Yet BIPOC women and girls often face significant barriers in accessing health care services after an experience of sexual assault (SA).[7] Examples of barriers experienced by BIPOC SA survivors include the race of the offender, historical trauma, mistrust, social isolation (particularly in rural communities), access to transportation and a telephone, differences in culture and values, confidentiality concerns, and location and type of services offered.[8]

Findings from Zelman et al[1] Specifically regarding higher rates of burnout among nurses who performed dual roles and saw higher numbers of pediatric patients underscores the importance of proper education, preceptorship by experienced SANEs, ongoing support, and mentorship. Trained, precepted, mentored, and supported SANEs provide a patient-centered trauma- and violence-informed nursing approach to patients. According to Befus et al[9] and Poldon et al,[10] the trauma- and violence-informed care approach enhances health equity and improves patient care outcomes. Yet the trauma- and violence-informed care approach also requires organizational change and ongoing training.[9,10] A trauma- and violence-informed approach in the provision of nursing care includes the centering of a safe nurse–patient relationship. It also includes patient empowerment through nursing health care options of care as well as skill building, debriefing, and support for the SANE. Trauma- and violence-informed nursing care enhances overall support to the patient to promote postassault healing while also promoting health equity and upholding social justice.[9,10] Amaret et al[11] note that trauma- and violence-informed training calls for all

SANEs to be committed to lifelong learning, having insight and knowledge and personally caring about their patients, including their cultural and social identity. It also requires SANEs to care how their patients encounter and navigate the intersectional experiences of racial, gender, and class oppression in their everyday lives.[11] Trauma- and violence-informed care is demonstrated and implemented through program development and sustainability by the SANE in the creation of a safe, quiet, and private space to allow for an intimate and sacred nurse–patient relationship to develop. This unique relationship ensures that patients are informed and aware and have the autonomy to make vital health care decisions. It is the physical as well as the emotional labor of SANEs that easily lends itself to burnout.

A future follow-up to the timely study by Zelman et al[1] is one that could help us better understand the phenomenon of SANE burnout, building on the authors' quantitative study to a qualitative study that captures the lived experiences of SANEs in a local context. Interviews with SANEs could offer valuable insight into the nuanced factors that lead SANEs to burnout by eliciting their lived experiences in caring for patients who experience violence and trauma. In addition, qualitative methodologies would elicit an understanding of the emotional experiences and triggers that SANEs may experience as they care for patients who experience violence and injustice in their everyday lives.[12,13] Narratives from SANEs garnered through qualitative inquiry could provide us with an understanding of an individual SANE's confidence in their training and learning regarding their scope of practice as well as how they apply evidence-based knowledge. Finally, qualitative research can offer the SANE an opportunity to self-reflect and create an opportunity to center the voices of SANEs with narratives and stories, providing insight into vicarious trauma and building nursing knowledge that enables us to address burnout.[13]

As practicing forensic nurses within the subspeciality of SANE (J.C.R, S.H., K.M.), we live, realize, and acknowledge the emotional toll related to the complex and intense nature of the SANE role. Apart from the emotional toll experienced as a result of the very nature of the SANE role, SANEs also observe the revictimization and re-traumatization of SA patients by not only health care personnel and the health care establishment but also by law enforcement.[14,15] SANEs across the United States thus face innumerable challenges in their practice.

SA is a heinous, devastating, and traumatic form of violence affecting both the physical and mental health of the individual and necessitates urgent, violence- and trauma-informed care. Access to and availability of trained, violence- and trauma-informed SANEs is imperative for patients, their families, and communities in creating a foundation of safety and healing.

Author Disclosures

Conflicts of interest: none to report.

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Burnout and the Sexual Assault Nurse Examiner: Who Is Experiencing Burnout and Why?: JEN

ABSTRACT (ENGLISH)

Introduction

A sexual assault nurse examiner role exemplifies the high-stress and highly emotional patient interactions that are often associated with burnout. The purpose of this study was to examine the frequency of burnout among sexual assault nurse examiners in North Carolina.

Methods

This cross-sectional study was an anonymous survey of practicing sexual assault nurse examiners within North Carolina using the Maslach Burnout Inventory and additional demographics. Results were analyzed with odds ratios, confidence intervals, Fisher exact, chi-square, and Kruskal Wallis tests as appropriate.

Results

Among 95 respondents, burnout was more frequent in sexual assault nurse examiners who stopped both emergency and nurse examiner work (55.6%, odds ratio 4.41, 95% confidence interval 1.07-18.06) and in dual function nurses (both emergency and nurse examiner work, 35.7%, odds ratio 2.71, 95% confidence interval 1.04-7.06). Sexual assault nurse examiners who had a high percentage of pediatric cases (above the median of 40%) were more likely to meet burnout thresholds for emotional exhaustion scores >26 (48.78% vs 25.93%, $\chi 2 = 5.30$, $P = .02$) and more likely to meet burnout thresholds for depersonalization scores >9 (48.78% vs 24.07%, $\chi 2 = 6.28$, $P = .01$).

Discussion

Higher frequency of burnout threshold criteria was found in those people who worked concurrently as a sexual assault nurse examiner and an emergency nurse and in those who had retired from both specialties. We also found that sexual assault nurse examiners with a higher case mix of pediatric cases had higher emotional exhaustion scores and higher depersonalization scores.

FULL TEXT

DETAILS

Subject:	Patients; Emergency medical care; Fatigue; Trauma; Severe acute respiratory syndrome coronavirus 2; Sexual assault; Burnout; Electronic mail systems; Thresholds; Confidence intervals; Severe acute respiratory syndrome; Nurses; Mental health; Depersonalization; Nursing; Sex crimes; Examiners; Pediatrics
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Response to Chary letter: JEN

ProQuest document link

FULL TEXT

Dear Editor:

We thank Chary et al[1] for taking the time to respond to our manuscript entitled “Delirium in Emergency Departments: Is it Recognized?”[2]

Delirium is perceived as a condition that primarily affects inpatient older adults.[3] Although older adults may spend several hours in the emergency department waiting for final disposition based on their required physical findings or diagnostics investigations, they are considered outpatients.[4] The assumption that most ED patients get discharged home and not admitted to the hospital gives false reassurance that these patients are less likely to develop delirium. Moreover, when older adults present to the emergency department, their cognitive dysfunction can be easily misinterpreted as their baseline or attributed to their acute illness. [2] Although the emergency department is an acute care setting, researchers in their studies and publications tend to group acute care settings together, ignoring the unique context of the emergency department. Several confounding factors affect the detection of delirium in the emergency department. Although the use of tools helps detect delirium, nurses repeatedly feel restricted in deciding on the steps they should follow after they suspect the presence of delirium.[2] Nurses in another study described dealing with delirium as *chasing a mirage*[5] because of the ever-changing presentation of the disease. The detection and diagnosis of delirium should initiate a management plan to prevent further cognitive dysfunction.[1,5] Delirium as a form of brain failure is a medical emergency but is rarely treated as such.[5] Treating delirium is not easy and should not be taken lightly because its mortality rates and the economic and human costs continue to rise.[1,3,5]

Our conviction is that the detection of delirium in the emergency department must be followed by a management algorithm similar to the ones triggered for chest pain or stroke.[4] The outcome would hopefully decrease delirium-associated mortality or morbidity—*Mohamed Toufic El Hussein*, *PhD, NP*, *is a Professor, School of Nursing and Midwifery, Mount Royal University, Calgary, Alberta, Canada, an Adjunct Associate Professor, Faculty of Nursing, at University of Calgary, Calgary, Alberta, Canada, and an NP at Cardiology CCU Alberta Health Services Rockyview Hospital, Calgary, Alberta, Canada; E-mail:* melhussein@mtroyal.ca. ***Twitter:*** https://twitter.com/drmohamednp. **ORCID identifier:** https://orcid.org/0000-0002-9489-3254. *Sandra P. Hirst*, *RN, PhD, GNC(C), Associate Professor, Emeritus, University of Calgary.* ***ORCID identifier:*** https://orcid.org/0000-0002-6579-5532.

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The Importance of Recharging: JEN

ProQuest document link

ABSTRACT (ENGLISH)

For emergency nurses, this new world includes continuous wearing of personal protective equipment and caring for patients in incredibly busy departments, all while we continue to be challenged with a nursing shortage. Education events, networking opportunities, and your ENA State/Chapter meetings can be a great way to make the connections. To this day, I still get excited on busy days, where managing patient flow within the department is like a giant puzzle to solve, seeing new chief complaints or new circumstances every shift, being present for someone in their most vulnerable time, and being able to help them through it.

FULL TEXT

Two years since the beginning of the coronavirus disease 2019 pandemic. Two years since our world, particularly in health care, was flipped upside down. What we expected to last for 2 weeks has now gone on for that many years. As emergency nurses, you have been immersed in caring for patients, learning new clinical practices to help those with coronavirus disease 2019 feel better, breathe easier, and transition back home to their family. It has not been easy, but there isn't a group of people who more deserve the title of hero. I applaud all of you for your dedication to our profession and to our patients.

Our world may be changed forever, and this reality a part of our new normal. Recognizing that things may not go back to how they used to be or how we once knew them can be difficult and even painful. For emergency nurses, this new world includes continuous wearing of personal protective equipment and caring for patients in incredibly busy departments, all while we continue to be challenged with a nursing shortage. That can be daunting, so for 2022 and for the years to come, I encourage you to find a way to recharge.

What do I mean by recharge? Recharge is finding your connection to yourself and your profession and reigniting the passion you have for emergency nursing. You can recharge in different ways. Taking care of yourself—eating well, resting, and focusing on your health—keeps you strong and ready to continue your work. You can also look to professional development, continuing education, certification, or networking with colleagues. Learning is endless in this profession, with new clinical information being presented literally each day. Take time to think about what piece of this interests you and what you think would help to reenergize you.

ENA offers a community of emergency nurses with whom to connect. These are colleagues who understand both the struggles and the comradery of the work we do. They know both how hard it can be and how much your team becomes a family. Education events, networking opportunities, and your ENA State/Chapter meetings can be a great way to make the connections. There are also options for connecting virtually, via ENA Connect.

I've been an emergency nurse for 20 years; finding ways to recharge along the way has kept me engaged, energetic, and focused on supporting emergency nurses to be the best possible caregivers we can be. To this day, I still get excited on busy days, where managing patient flow within the department is like a giant puzzle to solve, seeing new chief complaints or new circumstances every shift, being present for someone in their most vulnerable time, and being able to help them through it. Those moments help to keep the fire within me burning. I often joke with others, saying I'm wired to be an emergency nurse, because there just doesn't seem to be another way to describe how deeply connected I am to this work. My hope is that each of you find that same wiring and develop ways to recharge as you navigate through your career.

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Recommendations for Emergency Departments Caring for Persons with Opioid Use and Opioid Use

Disorders: An Integrative Review: JEN

ABSTRACT (ENGLISH)

Introduction

The emergency department is a primary portal to care for persons after an opioid overdose and those with an opioid use disorder. The aim of this integrative review was to provide best practice recommendations for nurses caring for this highly stigmatized and often undertreated population.

Methods

An integrative review was conducted using studies focusing on adults treated with opioid agonist-antagonist medications in the emergency department. The integrative review method by Whittemore and Knafl was used to guide this review and enhance its rigor.

Results

Twelve studies were included in the review. Opioid care begins with identifying opioid use risk, followed by implementing tailored strategies including opioid agonist-antagonist treatment if indicated, referral to treatment when warranted, and follow-up opioid use monitoring when feasible. Eleven recommendations provide guidance on integrating best practices into routine emergency care.

Discussion

The emergency department is an ideal setting for addressing the opioid crisis. Nurses can use the recommendations from this review to lead system change and more effectively manage the care of persons with opioid use and opioid withdrawal, and those at risk for opioid overdose.

FULL TEXT

Contribution to Emergency Nursing Practice

••The main findings of this paper are the best practices for (1) Screening: identifying and assessing persons who are at risk because of opioid use, (2) Brief intervention: delivering motivationally based interventions, (3) Pharmacotherapy: providing access to buprenorphine and naloxone, (4) Referral to treatment: making a referral to specialty treatment, and (5) Follow-up and monitoring: confirming that the patient is linked to treatment and outcomes are being monitored.

Introduction

The results of the 2019 National Survey on Drug Use and Health[1] reinforced that use of nonprescription opioids and heroin requires the attention of health care providers. In 2018, more than 9.7 million Americans aged 12 or older reported using a nonprescribed opioid or heroin, and 1.6 million were identified with an opioid use disorder.[1] Concerning is that in 2019, nearly 50 000 people in the United States died from opioid-involved overdoses,[2] and this number has increased during the coronavirus disease 2019 (COVID-19) pandemic.[3]

The impact of the opioid epidemic on emergency departments (ED) is evident given the prevalence of opioid-related visits to US emergency departments. Specifically, there were 234 million adult visits to emergency departments in the US across 2016 and 2017; 2.88 million (1.23%) were opioid-related.[4] Although not nationally representative, over 3000 emergency departments across 48 states and Washington, DC, contributed data on the number of ED visits for opioid overdoses in 2019 and 2020. The number of ED visits for opioid overdoses was higher in 2020 (N = 5075; mean = 306.9) than in 2019 (N = 3940; mean = 211.1).[4] State-level reports confirm those multistate trends in ED visits for opioid overdose before and after the pandemic. For example, in Kentucky, there were 1133 and 1323

opioid overdose-related medical service transports in the 52-day period before the pandemic declaration in March 2020 versus the same period after, respectively, a 17% increase.[5] Also recorded were 12 versus 18 emergency medical service runs for suspected opioid overdose with death at the scene pre- versus intra-COVID-19, respectively, a 50% increase in fatal opioid overdose.[5] A reasonable speculation is that as the COVID-19 pandemic continues, there likely will be an increase in fatal opioid overdoses, and more ED use by persons with opioid use. As such, there is an opportunity for emergency departments to address the needs of persons presenting after an opioid overdose and provide universal screening to identify persons who may be at risk because of opioid use, those who exhibit opioid withdrawal while in the emergency department, and those with a suspected or actual opioid use disorder.

The World Health Organization[6] and US Surgeon General[7] recommend prescribing or dispensing naloxone for persons who are at risk for opioid overdose. Among patients presenting to a US urban emergency department in March 1 to June 30, 2019 compared with those presenting during the early months of the COVID-19 pandemic (March to June 2020), the number of nonfatal overdose visits increased from 102 in 2019 to 227 in 2020; yet there was only a 2% change in patients receiving a naloxone prescription from 2019 to 2020 (54% in 2019 and 56% in 2020).[8] Rates of receipt of treatment resources (ie, telephone numbers and addresses of community treatment providers) or referral to treatment were slightly higher for the 2020 period (68%) than in 2019 (44%).[8] A comprehensive discharge plan should include naloxone access for persons at risk for opioid overdose and linkage to specialty treatment providers in the community.

Efforts to increase treatment access for persons with opioid use disorder are critically needed, given the estimated 1 million individuals who go untreated annually.[9] The emergency department is a prime point of contact for persons detected to be at risk because of opioid use, persons in opioid withdrawal, those surviving an opioid overdose, and persons with a suspected or confirmed opioid use disorder. This review was guided by the following question:Among persons presenting to the emergency department who may be taking opioids (eg, heroin, fentaNYL, opioids not prescribed to them), persons surviving an opioid overdose, those in withdrawal from opioids, and those with a suspected or confirmed opioid use disorder, what are evidence-based approaches and treatments that can be provided in the emergency department, and what are the outcomes?

The purpose of this review is to provide emergency nurses with the evidence for a variety of opioid-care strategies that can be implemented to address the needs of this population. Best practice recommendations are provided to guide emergency nurses to act, lead practice change, and initiate evidence-based purposeful interventions for improved care in this highly stigmatized, often undertreated population.

Methods

The integrative review method is an approach that allows for the inclusion of experimental research and has the potential to play a greater role in evidence-based practice for nursing.[10] Completion of all stages of this proposed methodology, with attention to the issues specific to undertaking an integrative review, has the potential to strengthen the process and the outcomes of integrative reviews. The following stages were followed to promote the rigor of this integrative review.

Problem Identification Stage

A clear problem identification and review purpose are essential to provide focus and boundaries for the integrative review process.[10] The crisis related to opioid use and the emergency department as a primary portal for treatment led to the clinical question for this integrative review.

Literature Search Stage

A health sciences librarian was instrumental in developing the search strategy to ensure a comprehensive search.

The search employed Medical Subject Headings terminology, truncations, and Boolean operators as applicable for the following databases: PubMed, Cumulative Index of Nursing and Allied Health Literature, and PsycINFO. The search dates spanned a decade, beginning with 2011 to capture any studies conducted before the landmark trial of ED-initiated buprenorphine treatment by D'Onofrio et al.[11] Key terms included opioid-related disorders, emergency service, hospital, delivery of health care, and model. Inclusion criteria were as follows: peer reviewed articles written in English that included adults in the ED setting and that studied interventions for persons with opioid use, opioid overdose, opioid withdrawal, or opioid use disorder. Excluded were articles that focused on substances other than opioids, settings other than emergency department, nonresearch, and samples focused on youth/children. The search strategy is provided in the Online Supplement.

Citations were imported into Covidence,[12] allowing the members of the team to work together on the project in real time. A total of 12 publications met the inclusion criteria. The Figure depicts the search results based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis.[13]

Data Analysis Stage

A thorough and unbiased interpretation of primary sources is critical for the data analysis stage.[10] The empirical reports were evaluated using the Johns Hopkins Nursing Evidence-Based Practice Guidelines framework through which evidence was appraised and leveled. In accord with the framework, Level I evidence included studies that employed a classic experimental design/randomized control trial (RCT); an explanatory mixed-methods study that employed an RCT; or any systematic review, with or without meta-analysis, of experimental studies/RCTs. Level II evidence included studies that employed a quasi-experimental design; an explanatory mixed-methods study that employed a quasi-experimental design; or a systematic review of a combination of RCTs and quasi-experimental studies, or only quasi-experimental studies, with or without a meta-analysis. Level III evidence included nonexperimental studies; a systematic review of a combination of RCTs, quasi-experiment, and nonexperimental studies, or nonexperimental studies only, with or without meta-analysis; exploratory, convergent, or multiphasic mixed-methods studies; explanatory mixed-methods design that includes only a Level III quantitative study; qualitative studies; or metasynthesis. Level IV evidence included opinions of respected/nationally recognized expert committees/consensus panels based on scientific evidence (clinical practice guidelines, consensus panels/position statements). Level V evidence included experiential and nonresearch work, such as integrative reviews; literature reviews; quality improvement, program, or financial evaluation; case reports; or opinions of nationally recognized expert(s) based on experiential evidence.[14]

Each team member extracted data (ie, study design, level and grade of evidence, sample, setting, measures, outcomes) from their assigned publications into matrices. Each matrix was reviewed by a second team member, and any revisions and additions were resolved in discussion with the primary reviewer. A further goal of the data analysis stage is the synthesis of the evidence.[10] Thus, the final step of this integrative review was the synthesis of important elements into an integrated summation of recommendations for care of the population in emergency departments.

Presentation Stage

The results of the integrative review capture the depth and breadth of the topic and contribute to a new understanding of the phenomenon of concern and implications for practice are emphasized.[10] This integrative review took into account the various scenarios of a patient being treated in the emergency department—from opioid use that puts the person at risk to persons with a suspected or confirmed opioid use disorder.

Results

Twelve studies were included in the review. On the basis of the Johns Hopkins Nursing Evidence-Based Practice Guidelines,[14] the majority of studies were Level III and only one study was a Level I. Sample sizes ranged from 18 to

2382. Across the studies reporting demographics, the samples were predominantly male, White, and for studies that reported age, participants were in their 30th year of life. Table 1 provides a summary of the studies organized in accord with each component of the continuum of care beginning with methods for screening for opioid use, assessment for opioid withdrawal and opioid overdose, and determination of opioid use disorder; approaches for a brief intervention; opioid agonist-antagonist medication provided; sources for referral to treatment; and outcomes related to follow-up monitoring. Table 2 provides an overview of medications included in this set of studies. More detailed information about those medications can be found in the Treatment Improvement Protocol from the Substance Abuse and Mental Health Services Administration.[15] Provided below is a summary of the continuum of care components based on the studies included in this integrative review.

Screening, Assessment, And Diagnosis Opioid Use and Opioid Use Disorder

Two studies described integrating a single screening question into the electronic medical record, "In the last 12 months have you smoked marijuana, used another street drug or used a prescription pain killer, stimulant, or sedative for non-medical reasons?" to identify opioid use.[16,17] Kelly et al[18] asked, "How often in the past 3 months have you used an illegal drug or used a prescription medication for non-medical reasons?" while others relied on documentation in the electronic medical record on self-reported use in the past 30 days,[19] an opioid diagnosis,[20] or documentation of cellulitis or abscess suggestive of intravenous drug use.[18] Opioid use disorder (OUD) diagnoses were given by a researcher,[11] physician,[21] or licensed social worker[18]; 2 studies used criteria from the Diagnostic and Statistical Manual of Mental Disorders[22] in diagnosing OUD. Retrospective studies relied on documentation of OUD in the medical record.[16,21,23]

Opioid Withdrawal

Nine studies in which buprenorphine was administered in the emergency department measured symptom severity via the Clinical Opiate Withdrawal Scale (COWS).[11,16,17,21,23-26] COWS cut scores for buprenorphine induction ranged from ≥5[24,25] to a score of ≥36 corresponding to severe opioid withdrawal.[11]

Opioid Overdose

Studies focusing on opioid overdose included patients with a documented history of opioid overdose[27] or those with a self-report of overdose since previous ED discharge.[19] Others assessed opioid overdose on the basis of the inability to conduct screening because of altered mental state[17] and decreased mental status or respiratory depression necessitating the use of naloxone before or during the ED visit.[20]

Brief Intervention and Education

Motivational interviewing, assessment of readiness to change, and level of motivation were components of the brief intervention (BI).[11,16-18] D'Onofrio et al[11] provided the most detailed description of BI and cited the manual and associated materials that were used to deliver it. The BI delivered in D'Onofrio et al[11] was a structured 10- to 15-minute conversation. Their BI also focused on suggested treatment options based on insurance coverage, residence, and preferences.[11]

Educational interventions focused on opioid overdose prevention, including use of naloxone,[19,20,27] or on buprenorphine.[21,25] Dwyer et al[19] employed ED-based licensed alcohol and drug counselors to deliver a 5-minute overdose educational intervention, composed of overdose risks, how to recognize and respond to a witnessed overdose by calling 911, delivering rescue breaths, and staying with the individual until the emergency response team arrived.[19] Of the 415 people who underwent overdose education, 56 (13%) received a naloxone kit with verbal and written instructions for its use, as well as the telephone numbers for poison control and the hospital pharmacy.[19] Samuels et al[20] provided naloxone kits and used a video to educate participants on overdose prevention, response, and naloxone administration for overdose reversal; bilingual printed instructions were included with the naloxone kit.

With a focus on buprenorphine, Hu et al[25] provided print educational materials explaining opioid withdrawal symptoms, options for managing withdrawal, and contact information for outpatient clinics and case management programs.

Buprenorphine Induction

Buprenorphine induction dosages ranged from 2 mg[25,26] to 8 mg[11,16,17] and varied across studies in response to a participant's COWS score. For example, participants whose COWS score was greater than 5 received 2 mg buprenorphine,[25] whereas Kaucher et al[26] used a COWS cut score of 6 to 12. Most buprenorphine prescribers were physicians; 2 studies[11,16,17] reported that these providers were federally waivered to prescribe buprenorphine. The only study reporting specific details about the provider involved in the induction was by Kaucher et al,[26] who reported that advanced practice providers conducted most of the buprenorphine induction (58%).

Naloxone Prescription

Four studies in which naloxone was provided at discharge from the emergency department reported that it was either prescribed[27] or freely provided.[19,20] The contents of the naloxone kits varied and included either 2 mg naloxone vials[19] or 2 doses of 2 mg of intranasal naloxone, a mucosal atomizer device, and pictorial with written assembly and administration instructions in English and Spanish.[20]

Referral to Treatment

Referral to treatment was used as a stand-alone intervention or to augment ED buprenorphine induction. D'Onofrio et al[11] employed a stepped approach to care. That is, participants assigned to ED buprenorphine induction underwent 10 weeks of protocol treatment then community-based ongoing treatment; those assigned to the screening and referral to treatment arm were provided a handout that listed addiction treatment services of varied intensity and duration that included their names and contact information and were categorized according to the participating insurance plans. Participants in the screening, BI, and referral to treatment arm of the study were directly linked with the referral, considering participant's eligibility for services, ensuring insurance clearance, and arranging transportation.[11]

Other studies employed continuity of care approaches after ED buprenorphine induction. Dunkley et al[21] provided follow-up treatment at the hospital's associated clinic, in which the providers who evaluated study participants in the emergency department were those who provided care in the clinic. Kaucher et al[26] employed a hub-and-spoke model in which the emergency department and the health center's outpatient center served as the hub, and the community health providers were the poststabilization spokes. Others relied on community resources, such as the rapid access outpatient community-based clinics for participants[25] and bridge-building or established relationships with community clinics.[16-18,23]

Follow-Up Buprenorphine-Focused Studies Initial Appointment

Participant follow-up with the first appointment after ED or home-based buprenorphine induction ranged from 53.4%[25] to 81%.[24] Participants referred to their hospital's associated clinic[21,26] reported that 63% and 74% attended their initial appointment, respectively. Provider-facilitated referral to treatment reported rates for keeping the initial appointment of 77.5%,[16] 61%,[18] and 64.4%.[17] Among studies in which community treatment referral was accomplished without active involvement, rates for attending the initial appointment were 81%[24] and 53.4%.[25]

Opioid Use

Using self-reported data for opioid use in the past 7 days and urine toxicology testing, D'Onofrio et al[11] obtained data for 244 of 329 patients (74%), representative of all 3 study arms: buprenorphine group, brief intervention group, and referral group. Although participants in all 3 study arms reported reduced opioid use, there were statistically significant between-group differences and group-by-time interactions. The buprenorphine group (n = 93 of 114)

reported greater reductions in the mean number of days of illicit opioid use per week, from 5.4 days to 0.9 days than the referral group (n = 69 of 104) from 5.4 days to 2.3 days or the BI group (n = 93 of 114) from 5.6 days to 2.4 days.[11] In addition, of 339 participants, 220 (66.9%) provided a urine sample for toxicology. There were no significant differences in rates of opioid-negative test results, with 57.6%, 42.9%, and 53.8% opioid-negative urine tests reported for the buprenorphine, the BI, and the referral study arms, respectively.[11]

Naloxone Education and/or Prescription/Kit Distribution Distribution Rates

Rates of naloxone distribution varied from a low of 13.5%,[19] to 35.4%,[20] to a high of 62.1%.[27] Of 58 participants, 22 (37%) declined the offered naloxone prescription[27]; among those participants who accepted naloxone, only 32.8% received a prescription at discharge.

Knowledge Retention, Opioid Use, Overdose Response

Dwyer et al[19] explored sustained overdose risk knowledge, opioid use, and overdose response for 51 respondents at 30-day follow-up. With respect to overdose risk, 73% identified the risk of mixing opioids with other substances, 31% identified risks related to opioid use after periods of abstinence, 22% identified the risk of using drugs alone, and 4% identified higher risk when chronic medical conditions were present.[19] Among these participants, 35% endorsed drug use, 22% reported opioid overdose survival, and 53% endorsed witnessing an overdose.[19] Among the 27 participants who witnessed an overdose, 93% stayed with the victim, 63% called 911, 26% performed rescue breathing, and 22% administered nasal naloxone. There was a trend for participants with those who received naloxone compared which those who received opioid overdose education to endorse overdose support interventions, but the difference was not significant.[19]

Peer Recovery Support Services

Across the set of studies, the peer recovery coach (PRC) worked directly with the person who could benefit from intervention, treatment, and recovery support. Whether employed by the emergency department[17] or hired by a partnering treatment program,[16,20] the PRC was an integral member of the health care team, [Table 3] provides the requirements for the PRC position and their responsibilities across the set of studies.[16,17,20]

Discussion

The purpose of this review was to provide nurses with evidence specific to a variety of opioid care strategies that can be integrated into routine ED care. Care of patients affected by opioid use begins with identifying opioid use risk, followed by implementing tailored strategies including opioid agonist-antagonist treatment if indicated, referral to treatment when warranted, and follow-up opioid use monitoring when feasible. The purpose of screening for opioid use is to identify risk, and when that risk is present, there is a need for further assessment and evaluation for an opioid use disorder. Persons who screen positive for opioid risk may not necessarily meet criteria for an OUD. Thus, there are opportunities in the ED setting for preventing the progression of opioid use to an OUD. The following recommendations for emergency nurses are made on the basis of this integrative review.

1. Screen all patients presenting to the emergency department for opioid-related risk using the single question, “How many times in the past year have you used an illegal drug or used a prescription medication for non-medical reasons, for instance, ‘because of the experience or feeling it causes?’ ”A response of 1 or more is considered a positive screen and, thus, triggers the need for further assessment.

2. Assess patients with a positive screen for type and amount of opioid used, frequency and duration of use, and route of administration. Be alert to signs of opiate withdrawal. Complete the COWS when symptoms first appear and subsequently to track opioid withdrawal and effectiveness of opioid agonist treatment. The technical assistance publication from SAMHSA[28] is a valuable resource for emergency nurses seeking further information

about opioid withdrawal, particularly in the context of buprenorphine treatment.

3. Assess patients who present after a suspected or confirmed opioid overdose and administer naloxone as indicated. Document information from the person or emergency responder about the number of naloxone doses administered and the elapsed time since rescued. Such information is important because multiple sequential doses of naloxone are indicative of potent synthetic opioids such as fentaNYL.[29] Opioid overdose risk is increased when there is a lifetime history of overdose,[30] and thus, it is important to assess and document any previous opioid overdose.

4. Defer diagnosis of an OUD to the qualified evaluator on the health care team or consultant to the emergency department (ie, physician, advanced practice nurse, physician assistant, licensed social work). In the absence of a formal diagnosis, the emergency nurse may suspect an OUD when there are signs and symptoms that reflect compulsive, prolonged use of opioids without medical purpose or opioid use greatly in excess of the amount prescribed.

5. Engage in a conversation with the patient about the recommendations and options after consulting with the health care team on the treatment plan. The emergency nurse can structure this discussion on the basis of the Brief Negotiated Interview format.[31] That is, the emergency nurse would begin by (1) raising the subject of opioid use, for example, “I’d like to talk with you about your use of oxyCODONE which is not prescribed for you.”; (2) providing feedback by reviewing the screening and assessment data and connecting opioid use and the ED visit; (3) enhancing motivation by asking the patient to identify the benefits and risks of opioid use and asking how ready they are to change their opioid use; and (4) presenting the proposed treatment plan.

6. Provide patient education related to any opioid agonist and opioid antagonist medication provided/prescribed, symptoms of withdrawal, and how to prevent opioid overdose. This patient education can be supplemented by published written materials such as those published by Wistanley et al.[32] Emergency nurses and advanced practice providers can advance their knowledge about OUD and medication treatment through free online courses, such as offered by the American Psychiatric Nurses Association,[33] and access a variety of educational materials at the Providers Clinical Support System website.[34] In addition, the emergency nurse should also anticipate needing to educate patients who will be referred to specialty treatment about what that entails.

7. Know which providers on the ED team or consultants can administer, prescribe, and dispense buprenorphine. A DEA X-waiver allows qualified physicians, nurse practitioners, and physician assistants to administer, dispense, and prescribe buprenorphine in any setting.[35,36] However, under the “three-day rule,” an ED practitioner can administer buprenorphine for the treatment of acute opioid withdrawal without a DEA X-waiver, up to 3 consecutive days.[36] If a clinical protocol is not in place to guide the implementation of buprenorphine treatment, the emergency nurse can lead the process to ensure that is in effect and disseminated to all ED health care team members. Emergency nurses can encourage their physician, physician assistant, and advanced practice nurse colleagues to become buprenorphine-waivered providers, directing them to the Substance Abuse and Mental Health Services Administration website.[37]

8. Implement a process for naloxone distribution for patients at high risk of overdose. That process would include ensuring that these patients are discharged with a prescription or a naloxone kit. Patient education should be provided on the indications for use, summoning emergency help, and how to acquire naloxone in the future.

9. Engage patients in the referral to treatment process as this entails more than identification of the need for more extensive treatment. That is, advising patients to seek treatment after discharge from the emergency department does not translate into them following through with the referral.

It is important to know what treatment resources are in the region served by the emergency department. Emergency nurses can advocate for establishing partnerships between their facility and treatment programs to improve care coordination and linkages to care. Emergency nurses can lead the development of innovative models of care, working in the emergency department and the specialty treatment setting in their facility, and evaluate outcomes of that care coordination model such as increased rates of engagement in specialty treatment after discharge from the emergency department.

Emergency nurses can engage patients in discussing and problem-solving potential barriers to acceptance of a referral, such as insurance, transportation, job, and family responsibilities. Emergency nurses can engage with other members of the health care team, such as social workers and PRCs, to assist in removing those barriers.

Emergency nurses can employ the warm handoff approach by engaging in communication with the prospective treatment provider and the patient. In this manner, the patient is included in the referral process, which helps reinforce the reason for the referral and allows them to correct or clarify the information exchanged.

1. Lead quality initiatives, such as calling patients to ensure that they are being followed-up on and monitored after discharge from the emergency department. This follow-up call provides the opportunity to ask whether the patient is experiencing any symptoms, and if so, triage to the most appropriate level of care. Such interventions could prevent complications that lead to costlier care and support timely access to care in the most appropriate setting.

2. Appeal for hiring PRCs as members of the health care team. As persons with lived experience in substance use recovery, PRCs are experientially qualified to support others who are at risk because of opioid use. The PRC whose role extends beyond the emergency department to the community is in a unique position to provide care across the treatment continuum, help link the patient to treatment, provide support for ongoing engagement in treatment, help remove structural barriers to treatment and recovery, and collect data for ongoing follow-up. In a freely accessible video with the link in the reference list,[38] 4 PRCs discuss how they applied for and were hired into the position, how their experiences prepared them to help others, their ability to be credible and authentic because of that experience, their engagement with the person from the first encounter, and their advocacy and support throughout the recovery process.[38]

Implications for Emergency Clinical Care

Emergency nurses are in key positions to lead system change. Practice changes should focus on the continuum of care for persons presenting to the emergency department with opioid use, in opioid withdrawal, or after an opioid overdose. Implementing the recommendations based on this integrative review would advance the quality of care for this population within the emergency department and extend support for the person after discharge and foster linkage to ongoing treatment.

Conclusions

Emergency departments are key settings in which interventions and treatments can be initiated for persons with or suspected of opioid use. All articles in this review demonstrated some aspect of the care continuum that can feasibly be provided within the emergency department. Despite variable approaches to linking individuals to community-based opioid-related treatment, the majority who were referred kept the initial appointment. As more emergency departments use SBIRT and provide opioid agonist-antagonist treatment, they will serve as exemplars for other

emergency departments and ultimately lead to widespread adoption of these lifesaving measures.

Author Disclosures

Conflicts of interest: none to report.

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Supplementary Materials

Online Supplement

Supplementary Materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.jen.2021.11.003.

First author	Design, purpose, level of evidence	Sample	Screening/Assessment	Brief intervention	Medication/prescriber	Referral to treatment	Follow-up outcomes
Bogan[16]	Retrospective cohort study Provide initial outcomes for 3 EDs in South Carolina for SBIRT + opioid agonist treatment Level III Grade B	n = 727 (n = 241 buprenorphine eligible) Demographics: not reported	Opioid use: "In the last 12 months have you smoked marijuana, used another street drug or used a prescription pain killer, stimulant, or sedative for non-medical reasons?" Opioid withdrawal: COWS* >8	Motivational interviewing Assessment of readiness to change Goal: encourage reduction or quitting use and engagement in treatment	Buprenorphine/naloxone 8-2 mg or Buprenorphine sublingual 8 mg Physician with X-waiver or under 3-d rule Naloxone kit	Area treatment providers (8-30 miles from ED)	Initial intake: 78% (187/241) Naloxone distribution: 209 of those with OUD

Devries[27]	Retrospective cohort study To assess whether any of 6 screening questions predicted naloxone prescriptions Level III Grade B	n = 182 Demographics: not reported	Opioid use and Opioid Overdose: Documentation of opioid prescription, OUD, current or past opioid use or history of opioid overdose	Education related to (1) preventing opioid-related overdose, (2) recognizing an opioid-related overdose, and (3) using naloxone should respiratory depression occur	Naloxone prescription (IM with syringe, intranasal, autoinjector)	Referred to pharmacy to obtain medication	Proportion treated: 31.9% (58/182) were recommended by MD to receive naloxone Naloxone acceptance: 62.1% (36/58)
D, Onofrio[11]	RCT Test efficacy of 3 interventions for persons with OUD Level I Grade A	n = 104; RT (S and referral) n = 111 BI (S, BI, RT to community-based treatment) n = 114 Buprenorphine (S, BI, ED-initiated treatment, RT primary care) Demographics (n = 329) Male: 76.3% White: 75.4% Age: 31.4 (SD = 10.6) Opioid overdose: 8.8%	OUD: Mini-International Neuropsychiatic Interview score ≥3 with positive toxicology for opiates or oxyCODONE Opioid withdrawal: COWS-moderate to severe withdrawal*	Brief Negotiated Interview 10-15 minute conversation based on structured framework. Tailored based on patient insurance, residence, and preference.	Buprenorphine/naloxone (dosage not reported) Home induction dosage: 8 mg on day 1, 16 mg on days 2 and 3) All physicians held X- waiver	Area treatment providers for those not receiving buprenorphine Buprenorphine group –10 wk in office-based clinic per research protocol then referred for ongoing care to community provider	Initial intake (30-d post randomization): Buprenorphine group: 78% (89/114) BI group: 45% (50/111) RT group: 37% (38/102): Opioid use in past 7 d: Buprenorphine group: 5.4 to 0.9 days (93/114) BI group: 5.6 to 2.4 d (93/111) RT group: 5.4 to 2.3 d (69/104):

Dunkley[21]	Retrospective cohort study Describe management of persons with OUD Level III Grade C	n = 18 (19 data points as 1 patient presented twice) Demographics: Male: 74% Race: not reported Age: 36 (IQR 29-52) Opioid overdose: 26%	OUD: diagnosis based on DSM documented by Medical Toxicology Fellow Opioid withdrawal: COWS ≥10	Education: After assessing for withdrawal, Medical Toxicology Fellow provides information about buprenorphine, the opioid antagonist treatment clinic, and alterative treatment options.	Buprenorphine/naloxone (2 mg-0.5 mg) Prescribers with X-waiver	Referral to hospital associated opioid antagonist treatment clinic	Initial intake: 64% (12/19)
Dwyer[19]	Retrospective cohort study Post discharge survey assessing overdose risk Level III Grade B	n = 415 Demographics: Male: 73% Age: 36 (SD = 10.6) White: 62%	Opioid use: self-reported use in the past 30 d Opioid overdose: self-reported overdose since discharge from ED	Education r/t opioids provided by ED-based LDAC. Content included:•overdose risks•how to recognize and respond to a witnessed overdose	Naloxone kit 2 atomized 2 mg vials Receipt depended on LDAC availability and patient preference. 13.5% (56/415) received naloxone kit	Not included	Survey completion rate: 12% (51/415) Past 30-d use: 35% Survived OD: 22% Witnessed OD: 52.9%•Called 911: 63%•Rescue breathing: 26%•Administered naloxone: 22%•Stayed with: 93%

Edwards[24]	Prospective cohort study Describe outcomes for ED-based buprenorphine administration. Level III Grade C	n = 62 Demographics: Male: 45% Race: not reported Age: 34 (median)	Opioid withdrawal: COWS ≥5	Not addressed	Buprenorphine / naloxone 4 mg 85% (53/62) met criteria for buprenorphine induction in ED Physician administered (not specified if X-waiver or 3-day rule)	Agreement with local clinic to reserve 80 intake appointments. Staff scheduled appointment during open hours (M-F, 9 am to 5 pm) or, if closed, directed patient to present the next morning.	Initial intake: 81% (50/62)
Hu[25]	Retrospective cohort study Determine retention in treatment after ED-initiated buprenorphine Level III Quality C	n = 49 Demographics: Male: 57% Race: not reported Age: 37 (SD = 12.3)	Opioid withdrawal: COWS >5	Educational materials:•Information on withdrawal symptoms•Options for managing withdrawal•Contact information for outpatient clinics and case management programs	Buprenorphine 2 to 4 mg sublingually 88% (43/49) induced in ED Buprenorphine prescription provided with up to 3 daily observed doses (Canadian pharmacy)	ED staff advised patient to go next day to rapid access treatment clinic accessible in community	Initial intake: 54% (23/43)

Kaucher[26]	Retrospective cohort study Opioid withdrawal Evaluate outcomes following ED-initiated buprenorphine Level III Quality B	n = 219 Demographics: Male: 56.2% White: 86% Age: 35 (SD = 10.3)	Opioid withdrawal: COWS 6 to 12 (Buprenorphine SL 2-4 mg) COWS ≥13 (Buprenorphine SL 4-6 mg)	Not included	Buprenorphine sublingual 2 mg up to 6 mg initial dose Physician assistants or nurse practitioners (X-waivered) conducted 58% of inductions. Narcan Rescue Kit	Opioid agonist treatment clinic, located on health center campus, served as “Hub” in “Hub-and-Spoke” model. If X-waivered prescribe Buprenorphine 16 mg maximum if >24 h delay in intake	Initial intake: 74%
Kelly[28]	Retrospective cohort study Evaluate protocol driven treatment with warm handoff. Level III Quality B	n = 120 Demographics: Male: 62.5% White: 69.1% Non-Hispanic: 77.5% Age: not reported	Opioid use: “How often in the past 3 months have you used an illegal drug or use a prescription medication for non-medical reasons?” query by RN. Provider documentation of cellulitis or abscess. OUD: 2 or more criteria met with DSM 5 OUD Checklist completed by social worker. Opioid withdrawal: COWS (by RN) ≥8	Motivational interviewing techniques used by social worker with assessment readiness/stage of change.	Suboxone 4 mg Suboxone provided when provider was available (7 AM-11 AM each day of wk) Buprenorphine prescription provided to bridge to intake appointment	ED social worker worked with community clinics to determine most appropriate, then discussed with patient to schedule follow-up appointment (ie, warm handoff). Call back number for social worker was provided to patient in event further assistance was needed.	Initial intake: 61% (70/120)

McLane[23]	Quality improvement To evaluate change in buprenorphine initiation rates over time when processes are put in place to increase uptake. Level V Quality B	n = 427 (n = 51 received buprenorphine) Demographics n = 51 receiving buprenorphine): Male: 48.9% Race: not reported Age (median): 34 (21-66)	Opioid withdrawal: COWS ≥12 (buprenorphine eligible) COWS <12 (home induction eligible)	Not included	Buprenorphine/naloxone (dose not specified) Naloxone kit	Participating clinics	Initial intake: 43% (16/37) Filled prescription after first ED visit: 74.4% (35/47)
Monico[17]	Retrospective cohort study To examine the scalability of SBIRT across 23 hospital EDs Level III Quality A	n = 950 with opioid withdrawal Demographics: not reported	Opioid use: "In the last 12 months have you smoked marijuana, used another street drug or used a prescription pain killer, stimulant, or sedative for a non-medical reason?" Opioid withdrawal: COWS ≥7 Opioid overdose: Unable to conduct screening due to altered mental state	Motivational interviewing based BI including assessing for motivation for treatment (trained by experts)	Buprenorphine/naloxone 8 mg sublingual Naloxone kit	Established rapid referral network in which programs would accept ED patients within 24 h of discharge	Initial intake: Buprenorphine administered: 64.6% (430/630) Opioid overdose: 74.2% (244/329)

Samuels 20	Retrospective cohort study To determine practice changes from pre- to post-implementation of LOOP program Level III Quality A	n = 555 Demographics: Male: 63.6% White: 82% Age:•18-29: 40%•30-50: 43.4%•51+: 16.6%	Opioid use: Documentation of diagnosis in medical record Opioid overdose: Opioid use resulting in decreased mental status or respiratory depression necessitating the use of naloxone before or during the ED visit	Education Pictorial and verbal instructions on assembly of naloxone for administration and administration instructions in English and Spanish	Naloxone kit: two doses of 2 mg intranasal naloxone, a mucosal atomizer device, and instructions	Documentation of one or both:•discussion with an outpatient treatment provider•specific treatment program follow-up details	Naloxone distribution: Total sample (n = 555): increased from none to 35.4%. (P <.001) Admitted with OD (n = 249): increased from none to 56.5% Received peer recovery coach consult when available: Total sample (n-555): 33.1% Admitted with OD (n = 249): 49.1% RT: Total sample (n = 555): increased from 9.16% to 20.74%. (P = .003) Admitted with OD (n = 249): D/C with RT increased from 1.9% to 14.9% (P = .01)

Medication	Indication	Description

Buprenorphine	Treatment for OUD	•Partial opioid-agonist –activates mu receptors•Displaces morphine, methadone, and other full opioid agonists from receptors and therefore can precipitate withdrawal; thus, assessing with COWS is essential•Long half-life (24 to 60 h) leading to prolonged suppression of opioid withdrawal and blockade of exogenous opioids
Naloxone	Reverses the CNS effects of opioid intoxication and overdose	•Opioid antagonist –blocks mu receptors•Rapid onset of action; short (approximately 4-h half-life)•May require higher doses when potent opioids (eg, fentaNYL) have been taken•Extended-release formulation is indicated for treatment of OUD; requires stopping use of any opioids for a period of 7 to 10 d before treatment initiation

First author	Requirements	Responsibilities
Bogan[16]	•Hired and supervised by local treatment program•Majority with 3-y of recovery•General Equivalency Diploma	•Screening•BI•Assess readiness for Buprenorphine•Referral to treatment
Monico[17]	At least 3 PRCs in each emergency department	•Respond to alert to see patient•For suspected opioid overdose: provide timely interventions focused on rapid harm reduction education, provision of naloxone kit, recording patient locator and contact information, refer to community PRC who would follow up in next day or 2 to offer additional support•Use motivational interviewing in delivering BI•Assess treatment motivation•Develop plan with patient•Make referral arrangements•Obtain consent to contact treatment program to confirm attendance•Contact provider to confirm follow-up•Document in electronic health record whether appointment was kept•Follow up to provide support and inquire about satisfaction with linkages
Samuels[20]	•In addiction treatment for ≥2 y•Completed 36 h PRC training•Employed by the partnering clinic•Completed HIPAA training•Available Friday 8 pm to Monday 8 am (due to limited funding)	•Respond to page within 30 min•Provide BI•Identify risk factors for recurrent overdose•Provide teaching on use of naloxone kit•Provide individualized support and addiction treatment navigation at the time of and after the ED visit

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Periodic Resuscitation Cart Checks and Nurse Situational Awareness: An Observational Study: JEN

ProQuest document link

ABSTRACT (ENGLISH)

Introduction

The periodic check of the function and integrity of the resuscitation cart is very important to ensure that the cart is prepared for use to provide emergency care to critical patients. Little is known about situational awareness during the periodic inspection of resuscitation carts. The purpose of this study was to measure hospital clinical nurses' situational awareness immediately after completion of a check of the resuscitation cart content and to directly observe and assess the resuscitation cart readiness in the selected hospitals.

Methods

An observational correlational study with a self-report measure design was used in which the Situation Awareness Rating Technique was collected immediately after the completion of checking of the resuscitation cart.

Results

Among the 332 nurse participants, the mean situational awareness score was 16.42 (standard deviation 5.26), reflecting an average situational awareness during the task of checking and inspection of the resuscitation cart. Knowing the policies and guidelines relating to resuscitation and the resuscitation cart is associated with the participants' situational awareness (F3,33 = 3.70, P = .04). In addition, working in critical areas and the number of years of working experience are associated with the participants' situational awareness (F2,33 = 3.24, P = .04 and F 3,33 = 3.00, P = .02, respectively). Assessing the resuscitation cart readiness revealed several issues such as empty oxygen tanks (32%); drained batteries and equipment failure (16%); incorrect size of equipment (16%); and missing, expired, and unavailable equipment (15%). Some of these issues were noted even though the carts were checked several times by different participants.

Discussion

Much work needs to be done, because inadequate situational awareness during the periodic check of the resuscitation cart content can affect patient safety in life-threatening emergencies.

FULL TEXT

Contribution to Emergency Nursing Practice

••A delay of 1 minute due to poor resuscitation cart readiness is associated with approximately 10% decrease in resuscitation success rates and outcomes.

••The common observations of resuscitation cart–related readiness issues identified were empty oxygen tanks (32%), drained batteries or equipment failure (16%), incorrect size of equipment (16%), and missing or expired equipment (15%), with fewer issues observed in the critical care units than emergency departments and other wards.

••Even though some of the carts were checked several times in the same shift by different participants, cart-related readiness failure was observed by researchers.

••Key implications for emergency nursing practice from this research include the need for more interventions to increase resuscitation cart readiness and nurse situational awareness during periodic resuscitation cart checks.

Introduction

A resuscitation cart is a movable storage device with a set of drawers and shelves used in emergency events in hospitals. It enables clinicians to intervene immediately, thereby saving time and lives. Resuscitation carts contain medication and equipment required to save patients presenting with life-threatening conditions.[1] Indeed, medications such as EPINEPHrine and equipment such as a defibrillator are essential to resuscitate respiratory arrest, cardiac arrest, drug overdose, and shock. Therefore, it is very important for nurses to continually ensure that all the needed elements and supplies are available and ready to use.

Resuscitation cart supplies and the preparedness and readiness of the equipment are core components of an effective resuscitation approach. For example, in emergency situations, a delay of 1 minute due to difficulties in accessing resuscitation cart supplies and equipment is associated with around a 10% decrease in resuscitation success rates and outcomes.[2] However, there are reports in the literature of a number of incidents in which resuscitation cart supplies were not available or outdated.[2] Such cart preparedness-related failure may have critical consequences for the timely and successful management of emergency situations and may lead to decreasing the chances of positive outcomes for patients with a life-threatening condition.[3-5] Emergency resuscitation carts need to be carefully checked, equipped, and maintained.[2] In this regard, recommendations have been made to have a consistent approach for organizing resuscitation cart drawers to reduce the occurrence of unsupplied or outdated medication incidents.[6]

Inpatient hospital clinical nurses as well as their counterparts in emergency departments must fulfill their general role as first responders in emergency situations. This can only happen if there is appropriate and well-functioning life-saving equipment and medication. Nurses are assigned to ensure that the resuscitation cart is in good working order and that all required items are available, up-to-date, and well-functioning.[2,7] However, it is not unusual for nurses to be required to answer telephones and respond to health care team members, patients, family members, and visitors during the checking procedure of the emergency resuscitation carts.

The working environment of nurses is complex and influenced by several contextual factors.[8] Monteiro et al[9] found that about 31% of nurses' activities were interrupted, and the mean number of interruptions per activity was 1.6. Researchers found that distraction and interruption can decrease nurses' situational awareness.[10] Likewise, distraction and interruption during resuscitation cart checking activity may decrease nurses' situational awareness and consequently may have critical consequences for patient safety.[11,12]

The concept of situational awareness is referred to as “the perception of the elements in the environment in a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.”[13] Many researchers have incorporated situational awareness as a key component construct when evaluating health care providers’ clinical performance in emergency situations.[14-16] Within these studies researchers recommended using situational awareness training to improve health care workers’ performance. Nurses' situational awareness in the context of resuscitation cart checking refers to identifying and making meaning of factors and elements relevant to the resuscitation cart activity and readiness. The concept of situational awareness is necessary for patient safety.[17] According to Green et al,[18] lack of situational awareness can result in poor outcomes and errors.

Situational awareness is fundamental for improving the performance of any activity,[11,12] including resuscitation cart checking. Many researchers have investigated situational awareness specific to patient care activities such as clinical observation, medication administration, and decision-making.[18-20] Meanwhile, much of the literature on resuscitation carts is about nurses’ compliance, knowledge, practices, and adherence to resuscitation cart guidelines, as well as medication errors, without being specific to situational awareness.[6,21] It is important to evaluate nurses’ situational awareness during the resuscitation cart checking activities, because it may have an important impact on the process and outcome of the cart checking activities and may have a potential to directly influence nurses’ performance. However, situational awareness has not been investigated in relation to the cart check procedure. This study seeks to fill this gap in the current literature by investigating hospital clinical nurses’ situational awareness immediately after completion of a check of the resuscitation cart content.

Aim

The purpose of this study was to measure hospital clinical nurses’ situational awareness immediately after completion of a check of the resuscitation cart content and to directly observe and assess the resuscitation cart readiness in the selected hospitals.

Methods Study Design and Setting

An observational design with participant self-report and direct researcher observation measures covering 3 main government hospitals in the Kingdom of Saudi Arabia was used, during a period of 4 months from January 2021 until April 2021.

Sample

It is a typical practice in the hospitals included in this study to have the resuscitation cart checked every shift by a registered nurse (RN). The task of checking the resuscitation cart is not limited to a particular RN, and all RNs are required to check the cart at some point during the year. Consequently, it is expected that all RNs in the 3 hospitals be familiar with and actively involved in the checking procedure. A convenience sampling technique was used in which all RNs (N = 2000) in the 3 hospitals were considered eligible for this study.

Sample Size Calculation

Fink and Major[22] investigated the situational awareness of 260 participants (pilots) using Situation Awareness Rating Technique (SART). In this study, sample size table for a correlation study[23] was used to identify the estimated sample size to detect low difference with alpha of 0.05 and power of 80%. Consequently, the estimated number of participants required should range from 59 to 751.

Data Collection Instruments

The research instrument consisted of 2 parts to collect data from the study participants. Part 1 was constructed by the researchers to elicit data on a variety of demographic characteristics of study participants, and part 2 was the SART instrument[24] to assess situational awareness.

Survey Part 1: Demographic

The demographic questionnaire included 7 items to provide a richer context for understanding the data. Each participant was asked to respond to the questions including those pertaining to employment as a hospital clinical nurse. This employment information included number of years since employment, category of unit at which the participant is assigned, and whether the unit is a medical, surgical, emergency, or intensive care unit. Information was collected if the participant had ever had training in the last 2 years: whether the participant had a certificate in basic life support, advanced cardiac life support, or pediatric advanced life support and was involved in resuscitation training events (mock codes). In addition, data were collected on whether the participant was familiar with resuscitation and resuscitation cart policies, quantified as the number of times participant reviewed the policies and procedures for the checking of resuscitation cart in the past 6 months. Data regarding the participant's age, education, and sex were also collected.

Survey Part 2: SART

Second, to gain a subjective assessment of participants' situational awareness during the entire procedure of checking and inspecting a resuscitation cart, the SART instrument[24] was used. SART is a self-report questionnaire that rates attention demand, supply of attentional resources, and an understanding of the situation on a 7-point Likert scale ranging from 1 (low) to 7 (high).

SART includes 3 dimensions and 10 items as follows: demand (3 items: instability, complexity, and variability of situation), supply (4 items: arousal, concentration on the situation, division of situation, and spare mental capacity), and understanding (3 items: information quantity, information quality, and familiarity of situation).

Justifying using SART to measure situational awareness

There are various objective techniques for assessing situational awareness including real-time probes and freeze probes. The Situational Awareness Global Assessment Technique[25] may produce the most valid and reliable measure. However, an alternative to an objective assessment of situational awareness is to collect subjective reports in which individuals rate their own situational awareness after the activity has been completed. The SART[24] is one of the most comprehensively tested rating scales for estimating situational awareness.[26] Its strengths come from its design featuring 3 logical phases: (1) scenario generation, (2) construct elicitation, and (3) construct structure validation.[27] SART is a multidimensional rating scale to assess operator perception of situational awareness. The technique assesses 3 dimensions of situational awareness: (1) understanding (U), (2) supply (S), and (3) demand (D). According to Taylor,[24] situational awareness depends on the quality and amount of information an individual receives (U), the complexity of the activity (D), and the ability of the individual to concentrate (S).

Validity of SART

The validity of SART was examined by several studies.[24,28] Although the tool has not been previously used in a health care setting, the tool was found to have high ecological validity in aviation when measuring situational awareness of flight crew as it has been developed in a real (nonartificial) environment.[26] SART can be administered during or immediately after the test task. In this study, the tool was given immediately after performing the procedure of checking and inspecting a resuscitation cart. This allowed the participants to know to which setting and period the questions referred.[29] Furthermore, it allowed the researcher to measure the participant's situational awareness during the entire procedure of checking and inspecting a resuscitation cart by determining the demand on the participant's attention, the supply of the participant's attention, and the understanding of the attentional resources available to the participant.

The overall SART score is calculated by summing the understanding (U) components and subtracting the difference of the sums of the demand (D) and supply (S): [situational awareness = Understanding–(Demand–Supply)]. SART scores range from –14 to 46.

Observation: Resuscitation cart readiness

A standardized checklist (Figure 1) was used as an observational instrument to assess the resuscitation cart readiness in the selected hospitals. The design of the checklist was largely due to previous cooperative efforts from Western Regional Health Directorates employee stakeholders. This standardized checklist works as a guiding tool to help hospital staff assess the readiness of the resuscitation carts in different units. Its use involved assessing the availability and functionality of essential equipment of the emergency carts.

Study Procedures Recruitment

A recruitment invitation was sent by email to all potential participants at the 3 hospitals. The email-based invitation strategy included an email describing the study purpose and nature (explanatory statement) and eligible participants, inviting participation, and a telephone number to call for more information. The emails were sent under the name of the principal researcher with the subject line, “Help us identify the influence of situational awareness on RN checking procedure of resuscitation carts.”

The researcher visited the 3 hospitals and sought the collaboration of department heads and participants’ agreement. It is a typical practice in the 3 selected hospitals to check the resuscitation cart at the beginning of each shift mainly in the first 2 hours of the shift. Hence, the visits for data collection were made in the first 2 hours of the day (7 am to 9 am) and during the afternoon shift (3 pm to 5 pm).

During the visit time, the researchers first met with the heads of the departments to explain the process of data collection. Any RN who worked in the department and received and read the recruitment invitation could agree to participate, regardless of whether or not they were assigned to check the resuscitation cart that day. This allowed all RNs interested in the topic to be involved in the study during the data collection time. Once the collaboration of the heads of the departments was agreed, interested participants were asked to sign a consent.

Situational awareness during resuscitation cart check

Once nurse participants consented to participate, they were asked to complete the first part of the survey (demographic questionnaire). Upon completion of this, the survey was collected by researchers, and the participant was instructed to perform the resuscitation cart check (Figure 2). During this step, participants commenced checking and inspecting the resuscitation cart content available in their department based on the hospital policy and procedure. The intention was to measure the situational awareness in the real working environment with its disruptions and distractions. Indeed, any interruption that occurred while participants were performing the task was not prevented, intentionally influenced, or manipulated by the research team. To limit any Hawthorne effect, the researchers stayed at a distance from the participants and waited for them to finish the assigned task.

After the participant completed the resuscitation cart check, we requested that the participant complete the SART instrument (the second part of the survey). This data collection step was timed immediately after the participant’s resuscitation cart check. Participants were instructed to rate the level of situational awareness they experienced while performing the resuscitation cart check task, using SART.

Direct observation of resuscitation cart readiness

The shift nurse in charge and a member of the research team directly observed the resuscitation carts at the end of each shift. In this study, a total of 138 resuscitation carts were identified in the 3 main government hospitals. The total number of these 138 resuscitation carts approached for observation in this study was 86, and 126 observations were made. In these observations, the resuscitation cart contents were reviewed, and the resuscitation cart readiness checklist was completed. There was no link to individual participant surveys or identifiers to gain study site access, as there was no intention to double-check any individual participant’s performance. Study procedures are summarized in Figure 3.

Ethics Approval and Consent to Participate

Ethical approval was granted from Ethics Review Committee of the Ministry of Health number HAP-02-T-067. Written informed consent was obtained.

Statistical Analysis

Data management and analysis were performed using SPSS Version 25 (IBM). The analysis included 2 parts. First, descriptive statistics (number, percentage, mean, median, range, and standard deviation) were used to describe sample characteristics. Second, 2-tailed *t* test and 1-way analysis of variance were used to examine whether there were statistically significant differences between the situational awareness of the nurse's scale or subscale during emergency resuscitation cart activity and demographic data. To control the likelihood of a type I error, an adjustment to the level of significance was done using a Bonferroni correction.

Results

A total of 332 participants agreed to take part in this study. Of these, 89% (n = 296) were female, and 76% (n = 253) held a bachelor's degree. The mean age of the participants was 34.15 (SD = 6.6). More than half of participants (69%, n = 227) had a work experience of more than 6 years. At the time of the study, 62% (n = 206) of participants were working in general wards, 20% (n = 68) in emergency areas, and 18% (n = 58) were working in critical care areas. A total of 79% participants had taken basic life support training (Table 1).

Situational Awareness Score

The mean scores for the demand dimension, the supply dimension, and the understanding dimension were 8.59 (SD = 2.83), 14.11 (SD = 3.42), and 10.9 (SD = 2.26), respectively. SART scores are limited to values between –14 and 46. The overall SART score was at the midpoint of this range 16.42 (SD = 5.26), which reflects that they had average situational awareness during the checking activity.

Situational Awareness Dimensions with Demographic Variables

One-way analysis of variance was used to investigate mean differences between the overall score of the situation awareness and the demographic variables. Among all the demographic variables, there were significant differences between the familiarity with the policies and guidelines relating to resuscitation and resuscitation cart ($F_{3,33}$ = 4.26, P = .04), working area ($F_{2,33}$ = 3.24, P = .04), working experience ($F_{3,33}$ = 3.00, P = .02), and the overall situational awareness score (Table 2).

The mean differences between each situational awareness dimension (D, S, and U) and the demographic variables were further investigated and are shown in Table 3. In general, there were significant differences between the SA-attention D and participants' age. In addition, there were significant differences between the SA-attention S and the familiarity with the policies and guidelines relating to resuscitation and resuscitation cart and working area. Finally, there were significant differences between the SA-U and the familiarity with the policies and guidelines relating to resuscitation and the resuscitation cart.

Cart Readiness

In this study, a total of 126 cart observations in the 3 main government hospitals were made. Table 4 shows the issues observed by researchers during the data collection process. It is worth noting that although that some of the observed carts were checked several times in the same shift by different participants as required by the study (Figure 3), issues related to readiness failure were observed by researchers. Analysis revealed that in 40 observations (32%), researchers noted empty oxygen tanks being left unfilled. Meanwhile, drained batteries and equipment failure were observed 20 times (16%). In 8 of these observations, the defibrillator battery was drained, and in 12, the laryngoscope light was not working. Furthermore, 20 observations (16%) revealed a lack of the presence of all adult and pediatric blades and paddles/pads sizes. Missing, expired, and unavailable equipment was observed 19 times

(15%) during data collection, as follows: 2 observations revealed missed cables and connectors, 16 observations revealed missing bag-valve masks of different sizes, and 1 observation revealed a missed O_2 flow regulator. In 6 observations, the carts were not secured, and 1 of these observations was found in the emergency department. These observed issues could contribute to patient safety events. Interestingly, critical care units tend to have fewer issues observed than emergency departments and other wards. As we did not link the checklist to individual participants, no correlation among participant situational awareness and cart readiness was tested in this preliminary study.

Discussion

Reviewing the larger amount of research conducted in psychology, cognition, ergonomics, and human factors and the lesser amount in the health care domain has allowed researchers in health care to understand what situational awareness is and how it can be measured.[20,30] This is the first exploratory research study conducted to evaluate the relationship between hospital clinical nurses, situational awareness during the checking of the resuscitation cart, and their demographic characteristics.

SART allows nurses to rate their perception on a variety of scales such as demand, supply, and understanding.[30] This study revealed that the overall situational awareness score from the SART was 16.42, indicating average but not high situational awareness. Participants' scores for each SART dimension (D, S, and U) were 8.59, 14.11, and 10.9, respectively. These results are lower than those reported in literature.[30] Indeed, Salmon et al[30] found that the situational awareness score of military pilots who were involved in a military task was around 19.75, and for S, D, and U dimensions, the results were, 13.9, 20.15, and 13.5, respectively. In another and more recent study, seafarers scored 23.18 overall situational awareness.[31]

Inadequate situational awareness has been linked to the failure of nurses to identify changes in a patient's condition, leading to failure to respond effectively to those changes to prevent deterioration.[19,32] In this context, some researchers have examined nurses' errors and lapses in clinical practice through the lens of situational awareness[20] and concluded that certain adverse patient outcomes resulted from lack of situational awareness. Accordingly, these conclusions were used to initiate quality improvement strategies focusing on improving the situation awareness level.[32]

Researchers have consistently reported that very often resuscitation carts are not ready for life-threatening emergency because of equipment failure or missing or outdated supplies.[33-36] This correlates with the results of this study. Such issues raise critical questions about whether this preparedness-related failure be attributed to a lack of situational awareness on the part of the person checking the cart. Thus, nurses who are not practicing with high situational awareness may increase the incidence of lapses and pitfalls,[9,19,37] with the potential to have a critical impact on patient safety.

In this study, results suggest that there is an association between greater experience and higher situational awareness. In particular, we found that there was an association between experience and attention resources of the situation and, consequently, increases in overall situational awareness. This is probably due to the influence of experience on implicit knowledge, which is the knowledge gained without the direct intention of learning.[38] Experiential knowledge is acquired through nurses' experience and mainly used unconsciously.[38] It occurs without intention and in the absence of awareness of what has been learned. Researchers have found that implicit knowledge enhances situational awareness through enhancing attention focus.[39]

Conversely, the explicit knowledge is a conscious learning process and can increase situational awareness.[39] Frequent reviewing of the required policy and procedure in this study is assumed to enhance the explicit knowledge through increasing attention resources relating to the situation, and understanding of the situation consequently

increases overall situational awareness. Researchers emphasized the importance of reviewing nurses' compliance with policies and procedures concerning resuscitation cart checking activities.[40] The influence of implicit and explicit knowledge on nurses' situation awareness may have implications for the maintenance of situational awareness during periodic checks of resuscitation cart supplies and equipment. However, little is known about this area of research.

In this study, results also suggested that nurses who are working in critical care areas tend to have more situational awareness compared with those working in general wards.[19] This might be because in areas such as critical care, nurses are more vigilant regarding any changes in a patient's condition.[20] Situational awareness is a mindset of vigilance.[41] This result is in agreement with evidence in the previously published literature, as nurses in intensive care units were found to have high level of vigilance in clinical practice.[42] Indeed, studies in cognitive psychology have shown that working in areas that require continuous focused attention increases situational awareness.[41] Adapting training to create behaviors that mimic those necessary for work in critical area environments and improved situational awareness is required for general ward nurses as well.[12]

The common observed issues in this study are drained batteries, equipment failure, inappropriate size of equipment, and empty oxygen tanks. These issues are similar to those previously reported in the literature[43,44] and, in combination, may produce delays in providing emergency intervention[43] and compromise patient safety. Lack of situational awareness may be the contributing factor of these incidents. However, this preliminary study did not examine the association between resuscitation cart preparedness failure and situational awareness. Studies investigating the relationship between situational awareness and resuscitation cart checking activities were not identified in literature to produce conclusive evidence about situational awareness influence. Therefore, we highly recommend additional empirical studies investigating situational awareness in relation to resuscitation cart–related preparedness failure.

Limitations

The study has several limitations. First, although there is a strong claim about the SART ecological validity and diagnostic capability in assessing situational awareness, SART is inherently limited by self-report factors such as recall error. However, this limitation was managed by introducing the tool immediately after completion of the test task to reduce the possibility of failure to recall. Second, the study did not assess whether there are differences in situational awareness scores among the 3 shifts (morning, evening, and night). Perhaps additional studies are required to assess this area of inquiry, for example, the influence of the work shift in participants' situational awareness. Third, participants knew that they were being observed, and this may have influenced their behavior. This limitation was managed by informing participants that their performance would not be double-checked.

Implications for Emergency Clinical Care

This study has assessed the situational awareness of hospital clinical nurses who work within various wards and units, in general, emergency, or critical wards. We recommend further studies be conducted to better understand the specialty-specific situational awareness during cart checks. However, our current study may have several implications for emergency nurses. For instance, training emergency nurses who have not developed a high level of situational awareness can compensate for the shortage of situational awareness. Indeed, training helps develop understanding of the situation. Information obtained from training experience can quickly and rapidly be recalled during an emergency incident and lead to a more rapid and efficient performance. In addition, training emergency nurses in situations requiring optimum attention is another critical way to ensuring an adequate response to an urgent clinical situation. Such training, when used effectively, can enhance nurses' vigilance, consequently promoting efficient response to emergency situations.

Many of the cart-related readiness issues that threaten the hospitalized patient's safety, including empty oxygen tanks, failure, or inappropriate equipment size, are observable and tangible issues. Creating clinical experience addressing as many of these issues as possible using low- and high-fidelity simulation to identify, practice, and evaluate situational awareness during cart checking procedure can make tangible the situations in which those issues occur.[45] Situational awareness requires utilization of electronic solutions such as a web-based resuscitation cart tracking system.[46] This electronic system is well described and often successful. It alerts nurses to any item missed or near its expiration date.

Emergency departments are highly stressful and dynamic work areas that can affect nurses and patient outcomes. Hence, it is of great importance to change the culture of the institution to empower emergency nurses to check resuscitation carts outside the high traffic areas or areas of high activity, where distractions are less likely. This may reduce factors contributing to cart preparedness–related failure.

In general, investigation of situational awareness with regard to checking the resuscitation cart is still in many ways in its infancy in the nursing emergency field, and the results of this study should be taken as a starting point for further studies to form a clearer picture. Using a more robust study design (eg, interrupted time-series experiment) able to determine the influence of interruptions on emergency nurses' work is recommended.

Conclusion

Situational awareness has been recognized as an essential factor for successful clinical performance in emergency situations. Although resuscitation carts may have hidden issues that could contribute to patient safety events such as expired or inoperable equipment, we cannot confirm whether situational awareness truly accounts for some of these preparedness-related failures. Further research should be undertaken, as this construct can affect patient safety in a life-threatening emergency.

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Author Disclosures

Conflicts of interest: none to report.

Variables	Categories	Frequency	%
Sex	Female	296	89.2
Male	36	10.8	Age group
20-30 y	117	35.2	31-40 y

167	50.3	41-50 y	39
11.7	>50 y	9	2.7
Education	Associate Degree in Nursing	66	19.9
Bachelor	253	76.2	Master
13	3.9	Years of work experience	0-1
11	3.3	2-5	94
28.3	6-10	114	34.3
>10	113	34.0	The number of times they reviewed policies and procedures in the past 6 months
0-1	70	21.1	2-5
142	42.8	6-10	43
13.0	>10	77	23.2
Additional training	None	1	0.3
ACLS or PALS	57	17.2	BLS

263	79.2	Mock shock	11
3.3	Unit	Emergency department	68
20.4	Intensive care units	58	17.5

Dependent variable	Demographic variable	Category	Mean situational awareness	SD	df	F	Sig
	Sex		-	-	330	2.03	.41
Situational awareness overall score	Age	20-30 y	16.15	5.207	3,32	1.641	.18
	31-40 y	16.17	5.051		41-50 y	18.05	5.680
	>50 y	17.56	6.88	Education	Associate Degree in Nursing	15.23	6.126
2,33	2.148	.12	Bachelor	16.70	5.031	Master	16.92
3.90	Work experience (y)	0-1	15.73	2.901	3,33	3.002	.02*
2-5	16.49	5.281	6-10	15.40	5.394	>10	17.45

5.09	The number of times they reviewed policies and procedures in the last 6 mo	0-1	15.14	4.927	3,33	4.257	.04*
2-5	16.37	4.659	6-10	15.92	5.806	>10	18.33
5.27	Additional training	ACLS or PALS	16.12	5.295	2,33	2.84	.63
BLS	17.21	4.753	Mock shock	19.36	5.75	Working area	Emergency department
15.60	5.362	2,33	3.24	.43*	Intensive care units	17.90	4.659

Dimensions	Demographic variable	df	F	Sig
	Sex	330	-1.603	.10
Demand	Age	3,33	3.13	.04*
The number of times they reviewed policies and procedures in the last 6 mo	3,33	0.86	.46	Working area

2,33	0.28	.76	Work experience	3,33
2.41	.07	Additional training	2,33	0.26
.77	Education	2,33	0.59	.55
	Sex	330	1.35	.18
Supply	Age	3,33	0.67	.57
The number of times they reviewed policies and procedures in the last 6 mo	3,33	3.70	.06*	Working area
2,33	2.98	.05*	Work experience	3,33
3.02	.45	Additional training	2,33	2.71
.07	Education	2,33	2.87	.06
	Sex	330	0.66	.51
Understand	Age	3,33	1.23	.29
The number of times they reviewed policies and procedures in the last 6 mo	3,33	3.04	.02*	Working area
2,33	1.12	.33	Work experience	3,33
1.89	.13	Additional training	2,33	3.59

.03*	Education	2,33	1.23	.29

Issues	Emergency departments		Intensive care units		General wards		Total (N = 126 obs)	
n	%	n	%	n	%	n	%	Oxygen cylinder (empty)
5	4	2	2	33	26	40	32	Missing, expired and unavailable equipment
4	3.1	2	1.6	13	10.3	19	15	Drained batteries or equipment failure

5	4	4	3	11	9	20	16	Unsecured carts (the safety device is not intact)
1	0.8	0	0.0	5	3.9	6	4.7	Size of equipment problem

DETAILS

Subject:	Emergency medical care; Patient safety; Hospitals; Life threatening; Employment; Questionnaires; Oxygen; Equipment; Morality; Researchers; Nurses; Emergency services; Supplies; Resuscitation; Clinical nursing; Risk assessment; Cognitive ability; Observational studies; Self report
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Cardiac Arrest Quality Improvement: A Single-Center Evaluation of Resuscitations Using Defibrillator, Feedback Device, and Survey Data: JEN

ProQuest document link

ABSTRACT (ENGLISH)

Background

High-quality cardiopulmonary resuscitation is foundational to cardiac arrest care. Visual feedback devices can

improve chest compression quality, but are infrequently used. Quality improvement data were examined to determine whether handheld visual feedback and backboard use improved chest compression quality, whether resuscitation team size affected resuscitation indicators, and whether feedback sources are comparable.

Methods

From August 2019 to December 2020, data from 50 resuscitations were collected using a handheld device (n = 35), defibrillator (n = 23), and surveys (n = 35) and shared with providers. Aggregated and individual case data, along with education and research, were distributed to staff as quality improvement measures.

Results

The mean duration of resuscitation was 1080 compressions (SD = 858); there were no differences in the durations of resuscitations that did or did not use handheld feedback; 50% of resuscitations used handheld feedback and had more compressions at target rate (74.68% vs 42.18%, t(21) = 2.99, *P* = .007). Moreover, 25% of resuscitations used backboards; these had more chest compressions at target depth (72.92% vs 48.73%, t(25) = 2.08, *P* = .048). Team size was not associated with duration of resuscitation or chest compressions quality. There was no improvement in other quality indicators (leadership, family presence, or debriefing) during the data collection period. Feedback sources (defibrillator and feedback device) had good agreement and correlation (r = 0.77, *P* = .01).

Conclusions

Incorporating handheld feedback and backboards improved chest compressions quality. Further work to improve the frequency of device use and to examine their relationship to patient-specific outcomes is needed. Study is needed to find interventions that improve other teamwork metrics, inclusion of family during the resuscitation, referral for tissue donation, and rates of postevent debriefing.

FULL TEXT

Introduction

Cardiac arrest is a leading cause of mortality,[1] and basic interventions such as high-quality chest compressions can improve defibrillation success,[2] the likelihood of return of spontaneous circulation,[3,4] and neurologically intact survival.[5] International resuscitation guidelines promote high-quality chest compressions[6] and continuous quality improvement (CQI) to improve resuscitation performance and survival.[7] Unfortunately, chest compressions quality is often suboptimal,[8–10] and despite chest compression feedback devices having been shown to improve compression quality[9–11] and survival,[12] they are often not available to clinicians.[13–15] Moreover, reviews have shown that other simple nurse-led interventions such as backboard use during simulated cardiopulmonary resuscitation (CPR) improve chest compression depth, but these have apparently not been assessed clinically.[16–18] CQI initiatives, despite having shown mortality benefit,[19,20] often face barriers to full implementation and frequently lack comprehensive data reporting.[14]

This project addressed the quality improvement (QI) problems of low chest compression quality, unknown optimal resuscitation team size, and whether chest compression quality measures obtained from different devices were comparable or not. This project used survey data to correlate data from 3 sources and describe quality indicators for cardiac arrest care. Correlating these data allowed for an examination of the reliability of data from different chest compression feedback sources and demonstrates that simple nurse-initiated interventions such as visual chest compression feedback and backboard use can increase chest compression quality metrics.

Methods

This project retrospectively examined resuscitation data that were collected from a single-center CQI project within a single emergency department. Data were collected using surveys and defibrillator and feedback devices. Results were communicated to staff in feedback cycles.

Design

This was a retrospective analysis of QI data that were collected from consecutive resuscitations performed over a 5-month period. Data were collected as part of an ongoing CQI initiative to improve cardiac arrest care using 3 existing data collection sources already in clinical practice: handheld visual feedback devices (CPRmeter 2, Laerdal Corp, Stavanger, Norway), LifePak 20 Defibrillator (Physio-Control Corp, Redmond, WA), and a locally developed QI

feedback survey (Supplementary Appendix 1) that measured priorities set as part of a province-wide priority setting and consensus exercise.[21]

Quality Improvement Feedback Cycles

Resuscitation data were shared with staff after each resuscitation, monthly, and quarterly. Individual resuscitation case data shared with staff included the device generated resuscitation reports from the CPRmeter 2 (Supplementary Appendix 2) and LifePak20 (Supplementary Appendix 3) for individual cases and aggregated resuscitation data in the form of a dashboard that detailed the percentage of cases using feedback and chest compression rate, depth, and release (Figure 1). Anonymized individual resuscitation case data were posted on a CQI board that was hung outside the resuscitation space and in the breakroom. In addition, staff were notified of updates using social media. Monthly reports were generated and distributed to staff and leadership as part of the department's QI council. Quarterly education focused on the clinical effects of backboard and feedback device use in the department and highlighted studies that support their use. Education was distributed to staff on the CQI notice board and by email.

Setting and Ethics

Data collection occurred between August 2019 and December 2020 and included the period from clinical incorporation of the visual feedback devices to the point at which data collection was halted because of the incorporation of LUCAS mechanical CPR devices (Physio-Control Corp, Redmond, WA) to limit the number of staff exposed to CPR-related aerosols[22] and the cessation of data collection owing to the redeployment of the principal investigator to support clinical operations during the coronavirus disease 2019 (COVID-19) pandemic. The emergency department is located in a community hospital that services 50 000 patients per year and is one of 4 metro hospitals serving a population of 1.4 million people.[23] Data were collected as part of a multiyear QI initiative. The project received institutional and regional operational approval. Ethical evaluation was performed using the A Project Ethics Community Consensus Initiative ethics guideline tool,[24] an online tool for determining levels of ethical risk and level of required ethics review. Data were collected without patient identifiers and as a routine practice for QI; therefore, it was assessed as low ethical risk and did not require full institutional review board ethics review. This project is reported according to the Standards for Quality Improvement Reporting Excellence 2.0 guidelines.[25] Our CQI project was based on the guiding principles of the systems of care and CQI methods of the 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.[7] Our CQI project attempted to improve patient care by highlighting beneficial processes changes (use of backboard) and by providing feedback equipment. The CQI project also attempted to improve the overall culture of our emergency department by adopting a just culture and a philosophy of continuous learning and improvement. Micro and macro plan-do-study-act cycles[26] were performed by CQI team leads and ED staff.

Providers

Provider demographics were not routinely collected for local QI initiatives. However, resuscitation teams comprised specially trained and licensed emergency care providers (ED physicians and nurses and prehospital providers) all of whom are required to maintain annually recertified CPR training as a condition of employment. The QI team consisted of 2 clinical nurse educators, the patient care manager, the zone clinical nurse specialist, and a project lead from another site in the zone. The program manager was responsible for clinical oversight, and the educators were responsible for data collection, feedback, and education. The zone clinical nurse specialist and project lead assisted with gaining project approval, data analysis, and manuscript preparation.

Outcome Measures

Data collection occurred within the context of QI, and the use of devices and submission of feedback forms were not mandated but left to clinician discretion. As a result, not all resuscitations have complete data from all 3 data collection sources (handheld feedback device, defibrillator, and survey). When multiple data sources were available, they were correlated by matching the resuscitation date/time data and in the case of surveys with a patient label that was affixed to the survey.

Data collected from the CPRmeter 2, a handheld device that was affixed to the patient's sternum using double-sided adhesive, included the time and duration (minutes) of the resuscitation; number of chest compressions; flow fraction

(duration of time with chest compressions/duration of time without); mean chest compression depth (mm), chest compression rate (compressions/minute), peak force in kilograms (kg), and cumulative pause time; and percentage of chest compressions at the target depth and recoil (2 inches or 5 cm) and rate (100-120 compressions/min).[27] These data were automatically recorded whenever the device was used and were downloaded using an accompanying computer application.

Data collected from the LifePak20 defibrillator included resuscitation time and duration, longest pause in chest compressions, number of chest compressions, number of pauses in chest compressions over a 10-second duration, mean chest compression rate, chest compression ratio (duration of time with chest compressions/duration of time without), and minute-to-minute breakdown of chest compression rate. These data were automatically recorded by the defibrillator and downloaded by infrared cable using CodeStat 11 (Physio-Control Corp, Redmond, WA). The inclusion of LifePak20 data allowed the QI team to assess how many resuscitations had data collected through the handheld feedback device and survey.

Data collected using the postresuscitation QI feedback survey included date, time, recorder, and patient demographic information so that follow-up could be performed if needed; fixed response fields for patient arrival and handover; resuscitation parameters that included team size, satisfaction with the number of providers, use of a backboard, and other interventions; feedback device evaluation; postresuscitation debrief data; and free-text space for staff to offer feedback on what went well and what could be improved (Supplementary Appendix 1). Data collection was voluntary and feedback surveys were returned to the QI project leads for extraction.

Statistical Analysis

Data from each source were matched, when possible, using device dates and times and were extracted by the clinical educators (authors C.P. and R.D.) into Microsoft Excel (Redmond, WA, Microsoft Corp). Statistical analyses were performed using IBM SPSS statistics 26 (IBM Corp, Armonk, NY). For descriptive statistics, normally distributed data were described using mean and standard deviations; for nonnormally distributed data, median and interquartile rangers were used. Differences in chest compression quality and duration of resuscitations between resuscitation that did and did not use a feedback device or a backboard were compared using independent *t* testing. Differences in chest compressions at the target depth, release, and rate between the numbers of staff involved were assessed using analysis of variance. Differences in survey responses during the second half of data collection (when both CPRMeter2 and LifePak 20 data were available) were examined using the Fisher exact test. Agreement between the resuscitations that were evaluated using 2 tools were compared using paired *t* testing, Pearson correlations, and Bland-Altman plots. All tests were 2-tailed with predetermined significance levels set at a = 0.05.

Results Feedback Characteristics

There were 50 resuscitations included in our analysis. Data collection using the CPRMeter2 and feedback survey occurred between August 2019 and December 2020. Because of administrative barriers and delays, LifePak20 data collection occurred between June 2020 and December 2020. A total of 35 resuscitations had data collected using the CPRmeter 2, 23 resuscitations had data collected using the LifePak20, 35 resuscitations had data collected using the feedback survey, and 10 resuscitations had data collected using all 3 methods (see Figure 2).

Feedback Survey Data

The feedback survey offered insights into resuscitation performance and staff perceptions and provided a means for making comparisons. Staff reported that a high proportion (more than 90%) of resuscitations had a clearly identified team leader and preassigned roles, that 80% of resuscitations were conducted with 4 to 7 staff members, and that staff were generally satisfied with the team size (Supplementary Appendix 4). There were 24 resuscitations occurring during the full data collection period. During this period, we saw no significant improvements in survey completion rates; end-tidal carbon dioxide use, preassignment of provider roles, clear identification of a leader, noninterruption rates during emergency medical service handover, smoothness of transfer, rates of referral for tissue donation, rates of debriefing, and rates of offering a bereavement package; or the number of staff (and satisfaction with staffing) present during resuscitations (Supplementary Appendix 5). In addition, there were no improvements in the rates of inclusion of family members in the resuscitation or the use of backboard and feedback devices (Figure 1, Supplementary Appendix 5). Despite

the remaining data fields having high (>25%) nonresponse rates, the survey data allowed us to group and compare feedback device measurements according to resuscitations team size and presence or absence of a backboard.

Handheld Device Feedback

Measures unique to the CPRmeter 2 were mean compression depth (mm) and peak force and the percentages of compression at target depth and recoil. Using these measures, we were able to compare resuscitations with and without a backboard and found that resuscitations utilizing a backboard achieved target depth on 72.92% (SD = 27.64, n = 12) of compression compared to only 48.73% (SD = 31.90, n = 15) of compressions when no backboard was used. Use of the backboard was associated with a mean difference of 24.18% (CI = 0.018-48.19) more compressions achieving the target depth of 2 inches, t(25) = 2.08, $P = .05$ (Figure 3). We did not find that there was a difference in the duration of resuscitation attempt or percentages of chest compressions at the target depth, release, or rate (all $P > .05$) between resuscitations with different sized teams (Supplementary Appendix 6).

Defibrillator Feedback

The defibrillator measured the same variables as the CPRmeter 2 and allowed us to make some inferences about the effect of visual feedback. There were no differences ($P > .05$) in duration (number of compressions) of resuscitations that used a defibrillator for feedback (M = 1103.00, SD = 711.02, n = 10) versus those with handheld visual feedback (M = 942.18, SD = 973.96, n = 11). When we examined the percentage of chest compressions at target rate (100-120 compressions/min) measures made by the defibrillator for resuscitation with (M = 74.68, SD = 22.39, n = 12) versus without (M = 42.18, SD = 29.63, n = 11) feedback, we found that those using visual feedback had 33% more chest compressions at ($t_{(21)} = 2.99$, $P = .007$) target rate (Figure 4). When we compared resuscitations that had quantitative measurements using both devices, there was a strong correlation between devices (r = 0.771, $P = .005$, n = 11) and no significant difference in the mean percentages (M = 0.0039) measured ($t_{(10)} = 0.01$, $P = .99$), with all values falling within the Bland-Altman confidence intervals of −36.72 and 36.72 (Figure 5).

Discussion

We successfully implemented a low-cost and impactful CQI cardiac arrest initiative that significantly improved resuscitation quality in multiple ways: we increased the percentage of chest compression within target range for rate (100-120 compressions/min) and depth (2 inches or 5 cm)[27] and determined that our resuscitation team size did not seem to affect chest compression performance. We determined that different methods of obtaining chest compression performance metrics are comparable and we affected the culture of cardiac arrest care in a meaningful and sustainable way.

The postresuscitation feedback surveys suggest that there was generally good team function and dynamics, and these findings align well with survey data from other countries.[14] Because the overwhelming majority of survey responses reported preassigned roles and a clearly identified leader, we were unable to examine the effects of leadership on resuscitation outcomes: future studies could consider finding objective measures for assessing leadership because staff may feel uncomfortable offering criticism of the team. The low rates of chest compression feedback use at our site are surprising given that the majority of Canadian emergency physicians (72.3%) in one study reported feedback devices should be a standard of care.[13] This may suggest that the decision to not use a feedback device may have been driven by other providers (eg, nursing staff) or that other tasks (eg, bed transfers, vascular access) may have taken priority. The increased rate of no family presence during COVID-19 and the low rates of structured debriefing at our site are comparable with other studies,[14,15] but these numbers need to be interpreted cautiously given the high nonresponse (data field left blank) rate. There were other survey fields that were frequently left blank (Supplementary Appendix 4); these questions directly addressed quality indicators and responses tended to be either positive or the field was left blank, despite other fields being completed. Previous research suggests that the decision to leave the field blank could be caused by the negative valence associated with reporting noncompliance with accepted best practices (and could represent social desirability bias)[28]; however, more research is needed to determine whether this phenomenon is true in resuscitation research.

Data from the postresuscitation feedback survey allowed us to compare resuscitations that did, or did not, use a backboard. Despite many previous studies assessing the effect of chest compression surface on compression

depth, a 2020 systematic review[17] and subsequent guideline update[18] suggest there are insufficient data to make strong recommendations on their use. A 2020 systematic review performed by the International Liaison Committee on Resuscitation did not find any clinical studies examining the effects of backboards on CPR in the clinical setting, suggesting that our results may the first of their kind.[17] However, these findings do need to be interpreted with caution given that depth measures provided by feedback devices may not accurately measure compression depth when performed on soft surfaces such as a mattress.[29]

The handheld visual feedback device seemed to improve chest compression rate compared with not using a device. This has been previously noted in simulation study data,[10] but as of a 2020 systematic review the CPRmeter 2 had not been assessed in a clinical setting, suggesting that these data may also be novel in the literature.[30] Although previous research has examined resuscitations using 2 data sources, our comparison between these 2 devices is novel for 2 additional reasons: the devices assessed and the analyses performed. There is limited previous research that examined resuscitation data from more than one device. One similarly structured study examined clinical resuscitation data gathered from CodeStat and a handheld feedback device data, but they did not compare the data sources.[31] Furthermore, there was one clinical study that evaluated handheld visual feedback device measurements using video analysis; they found that because of poor interrater agreement they were not able to compare the measures.[32] Simulation studies have compared the measured rates and depths by different devices using manikins with built-in chest compression analysis sensors and found that the rate measurements were comparable.[33–36]

Despite the emerging literature, there is an absence of data comparing the CPRmeter 2 with LifePak20 measured rates or comparison of multiple cross device measurements in a clinical setting. Our findings suggest that there is agreement between the CPRmeter 2 and LifePak20 measured rates and that they are a reliable method for assessing chest compression rate in clinical settings such as emergency departments.

Limitations

The findings in this analysis should be interpreted in light of the nonexperimental and retrospective nature of QI data, the patients typical to a predominantly adult community hospital population, the effects COVID-19 had on the data collection period, and limited collection of patient information. Although visual feedback seemed to improve chest compression rates in our sample, an experimental study is needed to determine whether the relationship is causal of the noted improvements. Likewise, establishing whether our noted correlation between improved chest compression depth and backboard use is causal would require an experimental design. Although we found the rate measurements generated by the LifePak and CPRmeter 2 to be comparable, the sample size was small and thus the comparison should be approached with caution. The survey data and chest compression metrics should be interpreted understanding that the resuscitations occurred at a nontrauma center community hospital and that the needs associated with special populations such as pediatric or traumatic cardiac arrests are likely quite different. The unprecedented impact of COVID19 resulted in the implementation of mechanical CPR and cessation of data collection. The incorporation of mechanical CPR reduced the number of standard CPR resuscitations. The redeployment of the principal investigator resulted in the abandonment of the CQI program. In addition, COVID-19 will have influenced many of the decisions made by the resuscitation team: the number of rescuers and ability to facilitate family presence during resuscitations, as well as postarrest tissue donation and debriefing. Finally, the outcome measures for this QI project did not include patient- or provider-specific data, and as a result, we are unable to report on patient-specific factors such as age and sex, patient-important outcomes such as return of spontaneous circulation and short- or long-term survival, or the effect that individual provider's characteristics (experience, fatigue, body stature, etc) may have had on performance.

Implications for Emergency Clinical Care

Continuous quality improvement may improve performance and patient outcomes. Chest compression feedback can improve chest compressions quality in simulation studies. Guidelines have supported chest compression feedback in practice, but there is a paucity of data describing whether devises that provide chest compression feedback improve care or patient outcomes, and whether different methods of assessing compressions have been compared. This paper presents 4 findings: (1) visual chest compression feedback increased the percentage of chest

compression within target range, (2) backboard use improved chest compression depth, (3) resuscitation team size was not associated with an overall performance, and (4) chest compression rate measurements made by different devices were comparable.

Continuous quality improvement of cardiac arrest care can be supported using defibrillators or handheld devices to guide chest compression performance. However, handheld visual feedback devices offer more data. Simple interventions like backboards and visual feedback can improve chest compression quality. Further research is needed to determine whether measures are consistent across different feedback devices and whether visual feedback improves outcomes.

Conclusions

Our work suggests that nursing-specific interventions such as the incorporation of handheld CPR feedback devices were associated with improved chest compression rates. Our work seems to be the first clinical (nonsimulation) study to show that backboard use during CPR is associated with an improvement in chest compression depth. We did not find that team size had an effect on resuscitation duration or performance and that the measures obtained from 2 sources were not significantly different. Further study is needed to compare the measurements made by similar different devices to see whether all devices have comparable measurements. Our data also suggest that additional investigations are needed to determine why providers do not use feedback devices and that additional supports may be needed to incorporate handheld feedback devices into more resuscitation attempts. The improvements we noted in chest compression quality suggest that further research is needed to determine whether chest compression feedback devices are associated with changes in patient-specific clinical outcomes such as mortality and neurologically intact survival.

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Author Disclosures

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Christopher Picard reports that Styker (Physio-Control) provided the software used for this project, but had no influence or participation on the design, conduct, or data analysis. Matthew J. Douma reports that Laerdal has provided resuscitation equipment for the purposes of resuscitation evaluation and research although they have had no influence on the design, conduct, or analysis of any project. The other authors have no conflicts of interest to report.

Supplementary Appendix 1

Quality improvement data tracking survey. CISM, Critical Incident Stress Management; CPR, cardiopulmonary resuscitation; EFAP, Employee and Family Assistance Program; EMS, emergency medical service; MD, doctor of medicine; RN, registered nurse.

Supplementary Appendix 2

Feedback device generated report. CPR, cardiopulmonary resuscitation.

Supplementary Appendix 3

Defibrillator generated report. CPR, cardiopulmonary resuscitation.

Supplementary Data

Supplementary data related to this article can be found at https://10.1016/j.jen.2021.11.005.

Data field	n	%
Providers had assigned roles		
Yes	32	91.43
No	3	8.57
Not reported	0	0
Team leader was identified		
Yes	34	97.14
No	1	2.86
Not reported	0	0
Uninterrupted EMS report		
Yes	25	71.43
No	3	8.57
Not reported	7	20
Transfer smoothness		
Very	9	25.71
Mostly	18	51.43
Somewhat	3	8.57
Not very	1	2.86
Not at all	0	0
Not reported	4	11.43
Number of providers in resuscitation		
2 to 3	0	0
4 to 5	5	14.28

6 to 7	6	17.14
8 to 9	1	2.86
10 or more	0	0
Not reported	12	34.29
Perception of staffing level		
Just right	29	82.86
Not enough	1	2.86
Too many	5	14.29
Backboard used during CPR		
Yes	10	28.57
No	13	37.14
Not reported	12	34.29
EtCO2 monitoring was used		
Yes	18	51.43
No	5	14.29
Not reported	12	34.29
Compression feedback improved care		
Significantly	17	48.57
Somewhat	1	3
Not very	7	20
Not at all	0	0
Not reported	10	28.57
Tissue donation was considered		

Yes	14	40
No	10	28.57
Not reported	11	31.43
Employee counseling resources were discussed		
Yes	0	0
No	26	74.29
Not reported	9	25.71
Family was offered a bereavement package		
Yes	13	37.14
No	11	31.43
Not reported	11	31.43

Survey Item	Resuscitation 27-30	Resuscitation 31-40	Resuscitation 41-50	Sig
Questionnaire returned				0.66
Yes	1	5	6	No
3	5	4	Feedback device used	
		0.66	Yes	1
5	6	No	3	5
4	Assigned roles			
0.71	Yes	1	4	6
No	0	1	0	Not reported

3	5	4	Clear leader	
		0.66	Yes	1
5	6	No	0	0
0	Not reported	3	5	4
EMS report uninterrupted				0.75
Yes	1	5	5	No
0	0	0	Not reported	3
5	5	Transfer smoothness		
	0.71	Very	1	2
4	Mostly	0	3	1
Somewhat	0	0	0	Not very
0	0	0	Not at all	0
0	0	Not reported	3	5
5	Number of providers in resuscitation			
0.75	2-3	0	0	0
4-5	1	1	3	6-7
0	3	3	8-9	0
1	0	10 or more	0	0
0	Not reported	3	5	4
Enough people				0.68
Just right	1	3	6	Not enough

0	1	0	Too many	0
1	0	Not reported	3	5
4	Was a backboard used			
0.73	Yes	0	3	2
No	1	2	4	Not reported
3	5	4	Was EtCO2 used	
		0.65	Yes	1
4	4	No	0	0
2	Not reported	3	6	4
Family presence offered				0.71
Yes	0	1	0	No
1	4	6	No family available	0
0	0	Not recorded	3	5
4	Tissue donation considered			
0.86	Yes	1	2	3
No	0	0	1	Not reported
3	8	6	Debriefing complete?	
		0.88	Yes	0
0	0	No	4	3
4	Not reported	0	7	6

Was a bereavement package offered?				0.42
Yes	1	2	2	No
0	0	3	Not reported	3

Quality metric	SS	df	MS	F	Sig.
Number of compressions					
Between groups	4 428 707.75	3	1 476 235.92	1.79	0.17
Within groups	29 724 536.15	36	825 681.56		
Total	34 153 243.90	39			
Release percentage					
Between groups	107.05	3	35.68	0.74	0.54
Within groups	1797.14	37	48.57		
Total	1904.20	40			
Depth percentage					
Between groups	4721.13	3	1573.71	1.71	0.18
Within groups	33 977.26	37	918.30		
Total	38 698.39	40			
Rate percentage					
Between groups	1157.08	3	385.69	0.54	0.66
Within groups	26 306.53	37	710.99		
Total	27 463.61	40			
Mean depth (mm)					

Between groups	349.48	3	116.49	1.17	0.34
Within groups	3594.42	36	99.84		
Total	3943.90	39			
Mean rate (compressions/min)					
Between groups	1748.38	3	582.79	1.21	0.32
Within groups	17 277.59	36	479.93		
Total	19 025.98	39			
Mean peak force (kg)					
Between groups	296.73	3	98.91	0.58	0.63
Within groups	6124.64	36	170.13		
Total	6421.38	39			

DETAILS

Subject:	Emergency medical care; Quality management; Feedback; Arrests; Mortality; Initiatives; Donors; Ethics; Teams; Teachers; Cardiopulmonary resuscitation; Visual feedback; Leadership; Clinical nursing; COVID-19; Chest; Cardiopulmonary resuscitation--CPR; Data collection; Biological organs; Myocardial infarction; Polls &surveys; Nurse specialists; Coronaviruses; Debriefing; Donations; Quality improvement; Heart attacks
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Nurses and Efficacy of Ultrasound-Guided Versus Traditional Venous Access: A Systemic Review and Meta-Analysis: JEN

ProQuest document link

ABSTRACT (ENGLISH)

Background

Ultrasound-guided venous cannulation is an increasingly popular tool for peripheral intravenous catheter placement

among nursing providers as opposed to standard of care landmark-based placement methods. This systematic review and meta-analysis assessed the use of ultrasound-guided versus landmark-based catheter cannulation among nursing providers across existing literature.

Methods

PubMed, Scopus, and Embase were searched for eligible studies from their beginning to June 11, 2021. Outcomes were the rate of first successful placement, procedure length, and number of total attempts. Bias and study quality were assessed using the Cochrane's Risk of Bias and the Newcastle-Ottawa Scale tools, respectively. Random-effects meta-analysis and assessed heterogeneity via Q-statistics and I2 values were used.

Results

The meta-analysis included 7 randomized clinical studies and 527 patients; 276 (52%) underwent ultrasound-guided cannulation and were associated with 2 times higher likelihood (odds ratio, 2.08; 95% confidence interval, 1.43-3.0; *P* <.001; I2 <0.001; 95% confidence interval, 0-18) of first successful placement by nurse clinicians. Ultrasound-guided venous cannulation by nurses was associated with similar number of attempts, procedure length, and patients' satisfaction, compared with standard-of-care cannulation.

Conclusions

This study demonstrated the advantage of nurses' ultrasound-guided venous cannulation over landmark-based cannulation methods for first successful placement, although other outcomes were not significantly different between methods. Additional multisite studies with adequately powered sample sizes are necessary to confirm these findings.

FULL TEXT

Contribution to Emergency Nursing Practice

••Ultrasound-guided venous cannulation, or USGIV cannulation, is becoming more popular, but its efficacy is not clearly elucidated.

••USGIV cannulation performed by nurses was associated with higher likelihood of first successful attempt. However, the number of attempts and length of procedures were similar between nurses' USGIV versus traditional method of peripheral venous cannulation.

••The recommendations for translating the findings of this study into emergency clinical practice include more USGIV training for emergency nurses and that further studies should investigate patient satisfaction.

Introduction

Peripheral intravenous (PIV) catheter placement is among the most common invasive procedures in the evaluation and management of patients in the emergency department, medical ward, and intensive care units (ICUs).[1] Traditional landmark-based PIV is dependent upon the presence of visible or palpable veins and is complicated by failure rates in up to 26% of patients, often because of many factors including body habitus, age, chronic comorbidities, or intravenous drug use (IVDU).[2] Previous clinical prediction rules for patients who would have difficult venous access included palpability and visibility of veins and history of peripheral venous access.[3]

Difficulty in obtaining PIV access is known to cause significant delays in patient care.[4,5] Historically, failed PIV placements required either insertion of a central venous catheter (CVC) or, if available, consultation to a vascular access service to obtain venous access. CVC placement carries an increased risk of serious complications including infection, pneumothorax, arrythmia, venous air, and thromboembolism.[6] Both CVC placement and consultation to vascular access teams can result in even further delays in patient management.

Point-of-care ultrasound (POCUS) can aid providers in placing PIV catheters among patients with difficult PIV access. POCUS allows for the identification of deep peripheral veins not identified on physical examination and survey for complicating anatomy such as tortuous vessels paths or bifurcations and allows for a dynamic

confirmation of PIV placement by visualizing an intravenous (IV) catheter within the lumen of a target vein.[7] Traditionally, ultrasound-guided peripheral venous access (USGIV) was performed by physicians. Nurses have performed USGIV more frequently[8] due to improvements in POCUS machine technology, and lower cost have made USGIV cannulation a more readily available technique for peripheral venous access by both nursing and physician clinicians. As a result, peripheral venous cannulation by nurses has become very popular and feasible. Multiple studies demonstrated that nursing USGIV protocols are safe and successful at obtaining vascular access in patients with known-difficult venous access.[8–10] USGIV protocols also result in a decreased need for physician vascular access interventions.[8–10]

Two meta-analyses were performed previously to compare cannulation by USGIV with cannulation by standard of care (SOC) among patients with difficult venous access.[11] One meta-analysis included 7 studies involving both pediatric and adult patients[12] and reported that USGIV cannulation was associated with higher success rates. However, this study did not specify how many attempts were necessary before the successful attempts. In contrast, a second meta-analysis showed that USGIV was not associated with higher first successful rate of PIV placement,[11] but USGIV was associated with higher overall successful rate than PIV by SOC. Neither meta-analysis specifically investigated the efficacy of nurses' USGIV cannulation.

Given that USGIV cannulation has become a more common nursing practice throughout hospitals, information regarding the procedural outcomes for USGIV cannulation represents a growing area of interest and a need for cumulative investigation, especially for administrators or nursing leaders to establish clinical programs for USGIV cannulation. Because no studies have investigated the efficacy of nurses performing USGIV cannulation and the first successful attempt, we performed a systematic review and meta-analysis to assess current literature about the efficacy of USGIV versus SOC landmark-based PIV cannulation by nursing providers in adult patients with expected or known-difficult venous access.

Methods Search Strategy and Selection

Our meta-analysis was conducted according to the 2015 Preferred Reporting Items for Systematic Review and Meta-Analyses.[13] We searched PubMed, Scopus, and Embase databases from their beginning to October 2020. The updated search was performed in the same databases between October 2020 and June 11, 2021. Our protocol was placed in Covidence software,[14] and there was no amendment to the protocol after the screening process began. The search terms were as follows in PubMed: ((“Catheterization, Peripheral”[Mesh] OR “Vascular Access Devices”[Mesh) AND (“Ultrasonography, Interventional”[Mesh] OR “Veins/diagnostic imaging”[Mesh]) AND (“emergency Service, Hospital”[Mesh] OR “emergency”[all fields])) NOT (“Central Venous Catheters”[Mesh] OR “arterial catheterization, peripheral” [MeSH] OR “Central venous catheter”[all fields] OR “midline”[all fields] OR “PICC”[all fields]).

Any studies involving nurses performing USGIV, which compared between USGIV cannulation and SOC, were eligible. Any experimental studies (any randomized trials); quasi-experimental studies, such as time series studies; and any observational studies, including prospective or retrospective nonrandomized studies, were also included. We also included studies of adult patients whose age was older than or equal to 18 years and studies in English language. Non–full-text studies (abstracts, conference reports) or studies that involved novel techniques (midline catheter, peripherally inserted central catheters, infrared devices such as the VeinViewer) were excluded. The included studies were searched for eligible references, but we did not contact authors for further information. We decided to focus on nurse interventionists because previous meta-analyses did not address the important question on whether nurses can perform ultrasound-guided peripheral venous cannulation effectively. The target was limited to venous access because registered nurses generally only cannulate veins and not arteries in traditional clinical

settings. Finally, pediatric patients were excluded because of other modalities of cannulations in pediatric patients, such as the near-infrared light device. These modalities have been used more frequently in pediatric population because of their lower cost and fewer training requirements.[15]

The search results were imported to Covidence software,[14] which was used to manage our search and screening process. Two investigators independently assessed each title and abstract. Any eligible title and abstract required agreement from 2 investigators to advance to the next step. Any disagreement was adjudicated by a third and senior investigator.

Outcome Measures

Our primary outcome was the rate of the first successful attempt from ultrasound guidance, performed by nurses, compared with SOC (palpation, landmark). Other outcomes included procedure length, in minutes, as defined by the authors; number of total attempts; and patient's satisfaction.

Quality Assessment and Heterogeneity

Similar to the process for title and abstract screening, 2 investigators independently assessed each included study for study quality. Any conflict was discussed and resolved by group consensus. Although we reported our final results as group consensus, we also measured inter-rater's agreement via weighted Kappa score. Kappa score ≤ 0.2 was considered poor agreement, 0.21 to 0.40 as fair agreement, 0.41 to 0.60 as moderate agreement, 0.61 to 0.80 as good, and 0.81 to 1.00 as very good agreement.

The Cochrane's Risk of Bias (RoB) tool[16] was used to assess risk of bias for any randomized trial and the Newcastle-Ottawa Scale[17] for any observational or other type of study. The RoB tool assessed each study across 5 domains (randomization process, deviations from intended interventions, missing outcome data, measurement of outcome, selection of reported results). If any domain was graded as having risk of bias, the study's overall assessment would reflect this risk of bias. The Newcastle-Ottawa Scale awards a maximum of 9 points for observational studies across 3 domains: quality of outcomes, comparability of groups, and cohort selection. High-quality studies achieve score ≥ 7, moderate-quality study have scores of 4 to 6, and low-quality study studies have score ≤ 3.

We used the I^2 statistic and Q-statistic to assess our meta-analysis' heterogeneity. The Q-statistic tests for the null hypothesis that all studies within our meta-analysis would share a common effect size. The I^2 statistic indicated that the percentage in variance of the meta-analysis' effect size was because of true variance and not sampling errors.

Data Extraction

Data were collected and entered into a standardized Excel spreadsheet (Microsoft Corp, Redmond, WA). Two investigators first extracted the data independently, before the inter-rater's agreement was calculated using the Kappa score. The difference was adjudicated by a third and senior investigator, and the final results were reported as the consensus of the group.

We collected studies' information including the studies' first authors' names, year of publication, study design (randomized trial or other, number of participants, types of nurses or other operators), and patient-specific data (eg, age, gender). Besides demographic data from the studies and patients, other clinical data that might have affected successful rates of venous cannulations[18] were also collected: patients' race, body mass index, history of renal dialysis, intravenous drug use (IVDU), sickle cell disease, and other. However, we did not report any of these data because most of the included studies did not report these data.

Statistical Analysis

There are fundamental differences between fixed-effects and random-effects meta-analysis models. Therefore, random-effects meta-analysis when any 2 or more studies reported the same outcome of interest was used. The

fixed-effects model assumes that the true effect size is similar among all included studies because their characteristics are very similar. In contrast, the random-effects model assumes that there is a common effect among studies, but these studies are still different among each other. In real-life practices, most studies would differ in how the patients are selected and how interventions and outcome are defined so random-effects model would be more suitable.[19]

Prevalence results (rate of first successful attempts) were expressed as odds ratio (OR) and 95% confidence interval (95% CI). Continuous data were presented as mean (standard deviation [SD]). When the studies reported data as median (interquartile range), we converted median to mean (SD) before performing analysis. Continuous outcomes (length of procedure, number of attempts, patient satisfaction) were reported as standardized difference in means (SDM) and 95% CI. As previously suggested,[20] an absolute SDM value ≤ 0.2 was considered a small magnitude between interventions and control group's effects size, an absolute SDM value of approximately 0.5 was considered a medium magnitude for effect size, and SDM value ≥ 0.8 was considered large magnitude.

Additional Analyses

Owing to anticipated heterogeneity among studies being included in our studies, moderator analyses with categorical variables were performed. To describe differences among studies that might potentially contribute to heterogeneity between studies, we decided a priori to use each available study's demographic information in moderator analysis, to quantify the level of heterogeneity from each available study's demographic information.[19] Furthermore, because of different study designs, sample sizes, and participants' selection, the effect size from one study may influence our study's overall effect size. For example, studies with small sample size can report large, positive findings, whereas large studies and more robust methodology would report nonstatistical finding.[19] Therefore, a sensitivity analysis was performed using one-study-removed random-effects meta-analysis. The meta-analysis would remove the very first study from the pooled study, which performed meta-analysis from the rest of the studies. It then removes the second study, while performing meta-analysis on the pool study of the first study and all other studies. By systemically removing individual studies, this sensitivity analysis investigates whether any one single study would affect the overall outcome of the meta-analysis' effect size.

We also performed random-effects cumulative analysis to assess the trend of the studies' effects over the years.[19] In this cumulative analysis, a random effects meta-analysis was performed with just one earliest study, and then a random effects meta-analysis added the second earliest study and performed meta-analysis on these 2 included studies. It subsequently added the third earliest study then performed a meta-analysis on these 3 included studies, and so on.

Our meta-analysis' publication bias was assessed using the funnel plot in addition to Begg's and Egger's tests. A symmetry of the included studies and Begg's test and Egger's test's $P > .05$ would suggest low likelihood of publication bias.[21] Additionally, the Orwin's fail-safe N test was performed to further assess publication bias. The Orwin's fail-safe N test would predict the number of missing or future studies that might have changed the effect size of our study's primary outcome.[19]

All one-study-removed meta-analysis, cumulative analysis, or our random-effects meta-analyses were performed with the software Comprehensive Meta-Analysis (www.meta-analysis.com; Englewood, NJ). All variables with 2-tailed *P*

Results

Study Description

Our electronic search identified a total of 284 studies; after full-text review, we included a total of 7 studies in the final meta-analysis of our primary outcome (Figure 1).

All 7 studies included within the primary meta-analysis were prospective studies, with randomized selection of patients into USGIV and SOC arms[9,22–27] (Table 1). All studies enrolled patients who had difficult venous access and

also needed peripheral venous access for clinical treatments. Three studies[9,22,26] defined difficult venous access from patients' self-report of previous history of having difficult access. Another 2 studies[25,27] identified difficult venous access as patients who did not have visible or palpable veins. Two studies[23,24] considered previous history of having difficult venous access, but also 2 failed attempts by SOC cannulation before enrolling them for their studies.

One study included an intention-to-treat model, with all patients requiring successful PIV placement for removal of CVCs.[18] All studies shared a common primary outcome of rate of first successful attempt. The studies varied in clinical setting, 3 occurring within the emergency department,[9,24,26] 3 within the ICU,[23,25,27] and 1 within the perioperative setting.[22] Our primary meta-analysis included a total of 527 subjects requiring PIV placement, with 276 undergoing USGIV and 251 via SOC (Table 1).

Study Quality

Given that all 7 included studies were randomized trials, only the Cochrane's RoB tool was used to grade the included studies' quality (Table 2). Three studies were assessed as having low risk of bias.[23–25] Four studies had some concern for bias.[9,22,26,27]

Primary Outcome: USGIV Versus SOC

USGIV placement by nursing was associated with a significant increased rate of first successful attempts compared with SOC landmark-based practices (OR, 2.1; 95% CI, 0.4-10.8; *P* Figure 2A). The *P* value for the Q-statistic was .59, suggesting that there was no significant difference between our study's effect size and the true effect size. Additionally, I^2 value for heterogenicity across our studies was **Sensitivity Analyses**

The cumulative meta-analysis (Figure 2B) shows a chronologic trend favoring USGIV by the addition of the third study, published in 2013 by Weiner et al.[9] Statistical significance of this chronologic trend over time is not achieved until the fourth study is added, but reaching an OR of 1.96 and *P* = .03. This trend continued to remain significant with addition of every subsequent studies, until the most recent one in 2020 by Nishizawa et al.[23]

The one-study-removed meta-analysis showed that odd ratios remained between 1.9 and 2.2 favoring USGIV when the meta-analysis systemically removed individual studies. This range of odd ratios remained well within the 95% confidence intervals of the pooled studies and suggested that no single study would have a significant influence on the primary effect size (Figure 2C).

Subgroup Analysis

Subgroup analysis using categorical variables was used to identify potential heterogenicity and to compare effect sizes between clinical settings and sample size. Differences between nursing clinical settings of the emergency department and ICU were assessed using the 6 publications within these settings (Table 3). Three studies were based within each setting and demonstrated no significance in between-group comparisons (*P* = .44). I^2 values across both settings were

Similarly, subgroup analysis between studies' sample sizes was also conducted. There was no significance between both groups (*P* = .68), and there was very low heterogeneity within each group (I^2 values were Table 3) to be consistent with the new numbering system. These data suggested the small study's effects.

Secondary Outcomes

Five studies[9,21,23–25] reported data on the number of PIV attempts by nursing (Figure 3A). Owing to differences in reporting methods across studies, the results are reported as a standardized mean difference, but demonstrated no statistical difference between favoring SOC and ultrasound guidance. Four studies[9,22,24,27] reported data on procedural length in minutes, favoring SOC, but cumulatively showed no statistical difference (Figure 3B).

Only 2 studies[9,25] included within our meta-analysis reported patient satisfaction data (Figure 3C). There was no statistical difference between SOC or ultrasound. Owing to the limitations of size and significant heterogenicity (I^2 =

77%; 95% CI, 14-95), few conclusions can be drawn from this analysis aside from the need for further investigation of this outcome in future studies.

Adverse Events and Complications

Three studies reported complications or adverse events.[23–25] Extravasations were reported by Bridey et al[25] and Nishiziwa et al.[23] The total number of catheter extravasations from the USGIV group was 21 (24%, 21 of 86 patients) compared with 13 (15%, 13 of 86 patients) for the SOC group, and it was not statistically significant ($P = .11$). Bridey et al[25] also reported 2 incidences of accidental catheter removal (4%, 2 of 56 patients) compared with 6 accidental removal (11%, 6 of 56 patients), and the difference was not statistically significant ($P = .10$). Bahl et al[24] only reported adverse events as the number of patients who needed alternative venous cannulation for rescue, which was not considered a true adverse event for the purposes of our review.

Publication Bias

Funnel plot and Begg's and Egger's tests were used to assess for publication bias for studies included within our meta-analysis. Symmetry was observed within the funnel plot ([Appendix]) with P values of Begg's and Egger's reaching .88 and .89, respectively, demonstrating low likelihood of publication bias.

Furthermore, the Orwin's fail-safe N calculation showed that, assuming that all potential missing or future studies would have odd ratio of 0.70, favoring SOC, 15 studies would be required to equate the efficacy of cannulation via landmark to that of USGIV.

Discussion

We found the rate of first successful attempt among nurse interventionists favored the use of USGIV over SOC. Our meta-analysis' result differed from a previous meta-analysis. van Loon et al[11] showed that ultrasound guidance was not associated with increased odds of first successful attempts. This finding was not only conducted from a smaller number of included studies (only 3 studies) but also from older studies, all of which were published before 2016. It was also likely that USGIV was not as familiar to nursing providers in 2016. Additionally, van Loon et al's[11] study included smaller studies for the outcome of number of attempts, and this outcome was not different between USGIV and SOC approaches.

Our study identified significant variations among the included studies. For example, nurses from each study were trained in different manners, and there were different levels of nurses' experience using ultrasound. Furthermore, most authors did not report on certain patients' clinical factors that could have affected the successful cannulations. Despite these heterogeneous populations, our meta-analysis showed very low I^2 values for the primary outcome and most of the secondary outcomes. These low I^2 values are encouraging because they indicated that almost all studies included in our meta-analysis agreed with a single effect: that is, ultrasound-guided venous cannulation is favored over SOC cannulation and would be associated with better outcomes.

There was an interesting trend with our cumulative analysis. There was a clear chronological improvement in the rate of first successful attempts by USGIV, given that the meta-analysis from the earliest 3 studies by Aponte et al,[22] Kerforne et al,[27] and Weiner et al[9] did not show clear benefits of using ultrasound, but adding subsequent studies demonstrated that USGIV was associated with higher odds of first successful attempts. This observation was most likely because of the increasing availability of POCUS, which improves nursing providers' familiarity with POCUS devices for IV cannulation given that USGIV is operator dependent.[17] We expect that future studies and future meta-analyses will likely demonstrate a better USGIV's efficacy in many outcome markers as ultrasound technology becomes more available.

Our moderator analyses of subgroups showed no significant difference in first successful rates between the clinical setting (emergency department or ICU) among nursing providers. This is possibly because of the similarly timed

adoption of USGIV practices and likely shared frequency of encountering patients with difficult IV access within these 2 clinical settings. Furthermore, as long as nurses are experienced and well trained, the success rates should not differ among different clinical settings, although further studies are necessary to confirm our observation. Given the demonstrated improvement in first successful attempts, nursing administrators within both settings may consider adopting clinical pathways for the earlier implementation of USGIV placement when patients are identified to have difficult IV access.

There was no significant difference in the number of attempts between USGIV and SOC. It was likely because of nurses' experience in our study, because it was shown that USGIV is heavily dependent on operators' experience.[28] There was substantial heterogeneity regarding nurses' experience in USGIV in our included study. Most of the studies did not report their nurses' experience with ultrasound-guided cannulation or what techniques of ultrasound-guided venous cannulation were used. In one study, nurse participants were required to perform only one successful attempt on a model vein,[9] and other studies required their participants to complete 4 to 10 successful ultrasound-guided cannulations before being part of the study.[24,25] This level of experience strongly suggested that most nurses in the included studies were not experienced with ultrasound-guided cannulation technique, which might have been associated with nonstatistically significant outcomes of procedural length and number of attempts. Consequently, there was no description of whether the nurses were trained with dynamic needle tip positioning, and it was less likely that the participants would be familiar with this technique, which had been shown to be superior to the palpation method and would have a lower number of attempts and shorter procedural time.[29]

Only 3 studies in our meta-analysis reported any complications or adverse events.[23–25] However, Bahl et al[24] only reported their adverse events as the number of patients who needed alternative venous cannulation for rescue. Therefore, we did not consider the need for rescue as true adverse events from venous cannulation. The overall pooled rate of extravasation in our study for either USGIV (24%) or SOC (15%) catheter groups was higher than previously reported. Favot et al[30] reported that the rate of extravasation from ultrasound-guided venous catheters was 4.1% compared with only 0.21% for SOC venous catheters. However, there were no factors reported being associated with the risk of extravasation, likely because Favot et al[30] also observed a small number of extravasations. Therefore, further studies with adequate sample size are needed to decide whether USGIV cannulation would be associated with higher rates of adverse events.

Inherently, USGIV is a more time-consuming process than SOC placement because of necessities such as sterilization of the probe, patients' skin, then providers' hand holding, manipulation of the ultrasound probe, and removal of ultrasound gel to place a catheter. Both van Loon et al's and our study showed that USGIV was not statistically associated with shorter time interval to successful cannulation. However, there was a difference between the 2 studies. Our study indicated that USGIV may have been associated with longer procedure time while van Loon et al's[11] showed that USGIV was associated with shorter procedure time.

Future Research

We also identified several potential areas for future research in USGIV placement by nursing providers. Future investigators should consider including many patients' clinical factors that might have been associated with successful cannulation. Some of those factors had been identified previously such as body mass index, patients' history of renal dialysis, sickle cell disease, and IVDU.[18] There was a lack about consensus on how to define procedure length. Aponte et al[22] defined procedure length as the total amount of time to successfully place a catheter, regardless of the number of attempts. In contrast, Bahl et al[24] defined procedure length as time interval from placing tourniquet to Tegaderm placement (tourniquet to Tegaderm), whereas other studies did not define their procedure length. Therefore, having a uniform definition on procedure length will allow researchers to assess

POCUS's efficacy more accurately. Furthermore, most studies did not include patient satisfaction when comparing the 2 modalities of PIV placement. Less than half of the included studies about USGIV by nurses used patients' satisfaction as an outcome. Furthermore, only 2 studies or approximately 1 of 3 of the included studies investigated the number complications, such as rates of extravasation of infused medications, arterial puncture, line infection, or soft tissue injuries, from either USGIV or SOC landmark-based cannulation. With the growing availability of POCUS and the number of patients with difficult PIV access, these areas represent important opportunities to identifying procedural improvement such as decreasing patient pain, stress, and anxiety while improving efficiency of delivered care.

Study Strengths

Our study also has a few strengths. Our study was the first meta-analysis demonstrating that nurses were able to establish significantly higher first successful cannulation rates by using ultrasound guidance than SOC cannulation. Our findings confirmed that the efficacy of ultrasound technology for nursing providers is not specific to any one ultrasound manufacturer, IV size, or venous location of cannulation. With the use of random-effects meta-analysis and a low heterogeneity across studies, our study's findings may be generalized to similar settings and similar patient population.

Limitations

There are many limitations to this meta-analysis. First, our review protocol was not registered with PROSPERO and did not receive external review. During the ongoing coronavirus pandemic, the PROSPERO team has not been able to review any non–coronavirus disease 2019–related protocols. Future studies would benefit from having external review. Additionally, there were a small number of studies in this field, which prevented us from performing moderator analyses in depth. Many of the included studies had relatively small sample sizes, which may inflate the effect size, causing the small study effect. There was no standardized procedural methodology among studies of the make and model of ultrasound devices, IV catheter size and length, or venous access sites used. However, this heterogeneity improves the generalizability of our study's findings given that different institutions invest in different vendors of both ultrasound machines and IV catheters.

Implications for Emergency Clinical Care

Our study demonstrated a clear benefit for USGIV placements by nurses in the emergency setting, as demonstrated by our subgroup analysis with studies. Further training programs to enable emergency nurses to perform more USGIV will benefit patient care and workflow. Based on our analysis, we anticipated that further studies involving nursing providers will show more efficacy from using USGIV, because our Orwin's fail-safe N analysis demonstrated that a large number of studies favoring SOC cannulation are required, to negate our current findings. This scenario of potentially negating our findings is less likely to occur as nursing providers become increasingly familiar with POCUS for IV cannulation.

Conclusions

The pooled analysis of this study shows a clear superiority of USGIV over SOC with respect to the rate of first successful attempts in patients with difficult venous access. This trend favoring USGIV over time improved in a chronological fashion and occurred in a likewise fashion between ED and ICU settings. The majority of the studies included within this meta-analysis had a small sample size. Adequately powered, multisite studies are indicated to confirm our observations and further investigate ancillary procedural outcomes.

Author Disclosures

The authors declared no conflict of interest.

Appendix

Funnel to assess potential publication bias in the meta-analysis comparing efficacy of USGIV and standard of care.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2021.12.003.

First author (y)	Study type	Total patients (N)	Clinical setting and definition of difficult access	Country	Nurse experience		Number of patients	Age (y), mean (SD)	Female, N (%)	Type of operator (N, %)	First successful cannulation, N (%)	Procedure length (min), mean (SD)	Number of attempts, mean (SD)	Patients' satisfaction (type of scale), mean (SD)	Any complications, (N, %)
2007 Apont e[22]	RCT	35	Setting: OR Definition: previous history of difficult access	USA	>3 y of experience	USguidance	19	55.5 (15.7)	15 (79)	CRNA (19, 100)	14 (74)	1.3 (0.5)	1.4 (0.7)	NR	NR

SOC: landmark, palpation	16	57.3 (18.9)	12 (75)	CRNA (16, 100)	13 (81)	3.1 (3.8)	1.3 (0.9)	NR	NR	2012 Kerforne[27]	RCT	60	Setting: ICU Definition: no visible or palpable veins	France	NR
US guidance	49	61 (17)	63	Nurse (49, 100)	42.9	7.25 (5.06)	NR	NR	NR	SOC: landmark, palpation	39	56 (15)	50	Nurse (39, 100)	28.2

6.67 (3.25)	NR	NR	NR	2013 Weiner[9]	RCT	50	Setting: ED Definition: previous history of difficult access.	USA	1 successful cannulation of model vein	US guidance	29	46.2 (14.6)	21 (72)	Physician (7, 24.1); Nurse (50, 100)	75.9

27.6 (31)	NR	Very satisfied, satisfied, somewhat satisfied, or not satisfied with	NR	SOC: landmark, palpation	21	53 (14.2)	12 (57)	Physician (11, 52.4); Nurse (50, 100)	47.60	26.4 (22)	NR	Very satisfied, satisfied, somewhat satisfied, or not satisfied with the total experience of IV placement (63.2% patient satisfaction)	NR	2014 İsmailoğlu[26]	RCT

		h t h e t o t a l e x p e r i e n c e o f l V p l a c e m e n t (8 6 . 2 % p a t i e n t s a t i s f a c															

		tion)													

60	Setting: EDDefinition: Previous history of difficult access	Turkey	Not specified	US guidance	30	52.7 (6.7)	19 (63.3)	Nurse (4, 100)	6 (20)	NR	2.1 (0.7)	NR	NR	SOC: landmark, palpation	30

	ess													
52.7 (6.7)	16 (53.3)	Nurse (40, 100)	9 (30)	NR	2.1 (0.6)	NR	NR	2016 Bahl[24]	RCT	122	Setting: ED Definition: Previous history of difficult access; 2 or more unsuccessful cannulations	USA	10 successful USGIV cannulations	US guidance	63

56.25 (16.75)	47 (74.6)	Nurse (63, 100)	48 (76.2)	20.7 (NR)	1.52 (NR)	NR	Rescue method required (11, 17.4), total complications (11, 1	SOC: landmark, palpation	59	56.25 (16.75)	43 (72.9)	Nurse (59, 100)	33 (55.9)	15.8 (NR)	1.71 (NR)

							7.4)							

NR	Rescue methods required (25, 42.4), total complications (2018 Bridey[25]	RCT	112	Setting: ICU Definition: no visible or palpable veins	Random	4 supervised successful USGIV cannulations	US guidance	56	65.2 (6.9)	22 (39)	Nurse (56, 100)	23 (41)	NR	2.0 (0.93)

	25,422.4)													

Likert scale, 8 (0.6)	Bleeding (0), local inflammation (0), pain (0), extravasa	SOC: Landmark, palpation	56	62.3 (6.6)	22 (39)	Nurse (56, 100)	18 (33)	NR	2.1 (1.4)	Likert scale, 8.1 (0.8)	Bleeding (0), local inflammation (0), pain (0), extravasation (9, 18), accidental catheter removal (6, 12), total complications (26.8)	2020 Nishizawa[23]	RCT	60	Setting: ICU Definition: no visible or palpable veins; 2 or more unsuccessful cannulations

tion(18,34),accidentalcatheterremoval(2,4),totalco

	mplications(20,35.7))													

Japan	5 successful supervised USG Vplacements ongel model, 3 su	USguidance	30	74.2 (14.7)	15 (50)	Nurse 30 (100)	21 (70)	NR	1.3 (0.45)	NR	Extravasation (3, 13.6), hematoma (0), obstruction (0), infection (0), total complications (3, 13.6)	SOC: landmark, palpation	30	79.4 (10.8)	10 (33.3)

successful supervised USGIV placements online patients

Study (y, first author)	Risk of bias arising from the randomization process	Risk of bias because of deviations from the intended interventions	Missing outcome data	Risk of bias in measurement of the outcome	Risk of bias in selection of the reported result
2007 Aponte[22]	Some concern	Low	Low	Low	Low
2012 Kerforne[27]	Some concern	Low	Low	Low	Low
2013 Weiner[9]	Low	Some concern	Low	Some concern	Low
2014 Ismailoglu[26]	Some concern	Low	Low	Low	Low
2016 Bahl[24]	Low	Low	Low	High	Low
2018 Bridey[25]	Low	Low	Low	Low	Low
2020 Nishizawa[23]	Low	Low	Low	Low	Low

Meta-analysis				Test of heterogeneity					Between-group comparison
Group	Number of studies	Odd ratio	95% CI	P	Q-value	Df(Q)	P	I-square (95% CI)	Clinical Settings
									ED

3	2.67	1.4-4.9	.001	0.25	2	.88	< 0.001 (0-1.9)	0.44	ICU
3	1.95	1.2-3.3	.01	1.66	2	.44	< 0.001 (0-1.9)		Study sample size
									< 75 patients
5	2.25	1.3-3.8	.002	3.5	4	.47	< 0.001 (0-1.62)	0.68	≥ 75 patients

DETAILS

Subject:	Intubation; Agreements; Emergency medical care; Software; Systematic review; Catheters; Drug use; Bias; Confidence intervals; Veins &arteries; Venous access; Nursing; Efficacy; Point of care testing; Pediatrics; Ultrasonic imaging; Nurses; Catheterization; Meta-analysis; Patient satisfaction
Identifier / keyword:	Nurses; Ultrasound-guided venous access; Landmark; Palpation
Publication title:	Journal of Emergency Nursing:; JEN; Philadelphia
Volume:	48
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Source type:	Scholarly Journal
Language of publication:	English
Document type:	Evidence Based Healthcare, Journal Article
DOI:	https://doi.org/10.1016/j.jen.2021.12.003
ProQuest document ID:	2635485097
Document URL:	https://www.proquest.com/scholarly-journals/nurses-efficacy-ultrasound-guided-versus/docview/2635485097/se-2?accountid=211160
Copyright:	©2021. Emergency Nurses Association
Last updated:	2022-03-15
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Journal of Emergency Nursing Diversity, Health Justice, and Inclusion Pledge: JEN

ABSTRACT (ENGLISH)

In particular, we grappled together if our pledge should maintain a heavy focus on race/ethnicity and historic inequalities experienced by those who identify as Black/African Americans. Accountability We strive and hold ourselves accountable for the full inclusion of editorial board members, authors, and reviewers who accurately reflect the nursing profession and specialty of emergency nursing with interdisciplinary emergentologists.4 There are many identities in which the nursing discipline and emergency nursing specialty fail to represent the patients we serve in emergency care.5,6 In response, we pledge our accountability by an editorial team composition that over-represents groups with identities from the census gap between our specialty and emergency care patients. Members of the editorial board, authors, or reviewers may choose not to disclose any or all of their internal identities to us.

FULL TEXT

Our Pledge to Our Journal Community

We pledge our commitment to health justice and genuine respect for all persons.

We pledge to prioritize and take meaningful actions to build and be worthy of trust from people who identify with historically disadvantaged and/or marginalized groups. We acknowledge that our commitment to health justice requires operationalizing equality and equity while removing barriers to equality so that each member of our Journal community, regardless of their identity, can experience full and meaningful inclusion in our work.

We pledge to create and maintain a social environment of cultural humility and continuous learning that honors intersectionality, which is the complex, cumulative way in which the effects of multiple forms of discrimination combine, overlap, or intersect in the experiences of marginalized individuals or groups.

Note from the Editor in Chief

In June of 2021, *the Journal of Emergency Nursing's (JEN)* Publisher at Elsevier contacted the editorial office about their Inclusivity and Diversity team initiative. This communication included a request for a tailored Journal pledge about a commitment to improve diversity (Scott Whitener, email communication, June 2021). The following pledge was generated through robust and respectful synchronous and asynchronous dialogue among *JEN* editorial board members. It was an honor to witness the tremendous humility, authenticity, commitment to our shared purpose and dedication to supporting colleague psychological safety that our editorial board demonstrated throughout this pledge development process. This collegiality was so important in the dialogue where opinions can vary widely, and emotions can run strong. In particular, we grappled together if our pledge should maintain a heavy focus on race/ethnicity and historic inequalities experienced by those who identify as Black/African Americans. Is it justified to address a group uniquely in this manner? Should we address ethnic disparities in general without naming any particular group? What about a priority focus on rural disparities in emergency care access? Should we individually list other disadvantaged and/or marginalized groups by religious affiliation, sexual orientation, or other identity? What about those over- or under- represented in nursing, but who experience social advantage or disadvantage outside the discipline in broader social contexts? Below, we publish the pledge we drafted to date as an editorial to spark continued consideration and dialogue with our readers. We welcome Letters to the Editor, commentary, and robust reader engagement with us on the topic.

It is important to note that our Journal editorial board pledge development process occurred independently and in parallel to the work of the Emergency Nurses Association's Diversity, Equity, and Inclusion (DEI) process.[1] The Emergency Nurses Association's official DEI Vision and Mission statements can be found at the link in the reference list,[2] which will also be posted at the *Journal of Emergency Nursing*'s homepage.[3] The ENA's Diversity, Equity, and Inclusion webpage also includes valuable resources on member engagement, cultural awareness resources, webinars, podcasts, toolkits, position statement, topic brief, and other staff recommended links.[2] Reader, we sincerely look forward to you joining us in this important conversation and work, as well as receiving your letters and responses.

Accountability

We strive and hold ourselves accountable for the full inclusion of editorial board members, authors, and reviewers who accurately reflect the nursing profession and specialty of emergency nursing with interdisciplinary emergentologists.[4] There are many identities in which the nursing discipline and emergency nursing specialty fail to represent the patients we serve in emergency care.[5,6] In response, we pledge our accountability by an editorial team composition that over-represents groups with identities from the census gap between our specialty and emergency care patients. In particular, we seek to over-represent men in nursing, religious minorities, people from other groups who have been marginalized, people with disabilities, and those with Black, Indigenous, and people of color identities. Although we aim to be inclusive of all groups, we acknowledge the profound and long-standing impact of historic anti-Black racism on health justice and opportunities in the nursing profession.[7-12] Thus, our commitment to justice and inclusivity may include a special initial focus on people with Black identities in the census gap between the specialty and the patients we serve.

Transparency

In full transparency, we acknowledge that diversity and identity aligned with a historically disadvantaged or

marginalized group may not be apparent by outward appearance, name, or linguistics alone. Members of the editorial board, authors, or reviewers may choose not to disclose any or all of their internal identities to us. Although we aim to be trustworthy stewards of these disclosures, we acknowledge that our effort will be dynamic and necessarily require transparency about the uncertainties of our full diversity and representation. This will not lessen our commitment or accountability to full diversity, inclusion, and representation among our authors, reviewers, and editorial board.

Broader Publishing Community

Our work leads, amplifies, and is aligned with Elsevier's broader ongoing inclusion and diversity efforts to strengthen and advance us all.[13]

DETAILS

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External jugular vein peripheral intravenous catheters: An emergency Nurse's guide: JEN. (2022). Journal of Emergency Nursing, 48(3), 303-309. doi:https://doi.org/10.1016/j.jen.2022.01.009

Insertion of a peripheral intravenous catheter into the external jugular vein is regularly performed in emergency departments to treat patients with difficult intravenous access. Although emergency nurses are experienced in inserting peripheral intravenous catheters, there is an inconsistent practice and a lack of education and training regarding the insertion of catheters in the external jugular vein. This manuscript provides a practical guide for emergency nurses to care for patients who require an external jugular peripheral intravenous catheter. Key information found in this manuscript includes indications for external jugular intravenous access, the nurse's role in performing external jugular peripheral intravenous catheters, and clinical considerations when caring for patients with an external jugular peripheral intravenous catheter.

Professional self-concept, job stress, and triage competency among emergency nurses: Secondary data analysis of a cross-sectional survey: JEN. (2022). Journal of Emergency Nursing, 48(3), 288-298. doi:https://doi.org/10.1016/j.jen.2022.01.010

IntroductionThis study aimed to evaluate the indirect relationship of job stress with triage competency through professional self-concept among emergency nurses in Korea.MethodsA secondary data analysis of survey data from 132 questionnaires was used. A convenience sample of emergency nurses working in regional or local emergency centers in 2 Korean cities was recruited for the survey. Study variables were analyzed using descriptive statistics, correlation, and a model tested using the Hayes PROCESS macro (Model 4) mediation model.ResultsJob stress alone was not associated directly with triage competency (β = 0.01, P = .74). An indirect pathway was observed between job stress and triage competency through professional self-concept (F = 5.85, P < .001, R2 = 0.33). In the tested model, job stress was associated with professional self-concept (β = −0.05, P < .05) and professional self-concept was associated with triage competency (β = 0.79, P ≤ .001).ConclusionProfessional self-concept may be an important determinant of triage competency among emergency nurses. To increase triage competency among emergency nurses, individual nurse and management efforts are recommended to foster professional self-concept and reduce emergency nurse job stress.

Board of directors: JEN. (2022). Journal of Emergency Nursing, 48(3) doi:https://doi.org/10.1016/S0099-1767(22)00071-X

The great resignation, newly licensed nurse transition shock, and emergency nursing: JEN. (2022). Journal of Emergency Nursing, 48(3), 236-242. doi:https://doi.org/10.1016/j.jen.2022.03.010

ECRI boldly called out the impact of precipitating workplace factors stemming from electronic health records (EHRs), time pressures, heavy patient workload, patient complexity, rapid change, and limited resources on a workforce largely comprising high achievers.4 They emphasized the importance of listening to clinician concerns, leveraging change at the system level to address the underlying causes such as improper resource allocation, and ending the treatment of employees as "cogs in a wheel." Workplace elements solidly coupled with emergency nurse burnout and turnover include difficult work schedules and shift work, inadequate support by leadership, and escalating workplace violence toward staff.7,8 Layer on frustrations caused by a lack of essential supplies and equipment, barriers to patient flow, inadequate staffing relative to demand, and ever-increasing regulatory burdens. COVID-19 added the threat of infectious disease contagion, potentially without adequate or appropriate personal protective equipment, and worsened the nurse-specific trauma of caring for scores of critically ill and dying patients in a time of insufficient and even rationed resources.9-11 The system dysfunction that created the conditions for nursing burnout and turnover before the pandemic was magnified by COVID-19–related surges and stressors.12,13 While temporary and travel nurse staffing agencies have long filled a need for short-term nursing labor demands, the value and demand for nursing skills multiplied during the pandemic.14,15 For institutions that had undervalued long-term nurse employees and nurse retention, the pay gaps between loyal nurse employees and temporary or travel nurses

created further backlash from employees, contributed to additional turnover, and saw institutional attrition spiral. The prolonged pandemic disaster context exposed emergency nurses to additional risk factors for burnout, grief injury, fatigue injury, moral injury, and traumatic injury.11,13,21 In the resulting gaps in stable existing workforce supports, we also discuss how quintessentially timely and important regional and specialty-wide resources and infrastructure will be for new nurse transition support.21,22Transition Stages and Transition Shock Models The first year of professional nursing is profoundly transformative.19 Assuming supported and evolutionary developmental knowledge and skill pathways were offered during nursing education, one might expect that new nurses would be able to anticipate a relatively stable postgraduate period rather than the steep, dynamic, and tumultuous learning curve they actually find.

Information for readers: JEN. (2022). Journal of Emergency Nursing, 48(3) doi:https://doi.org/10.1016/S0099-1767(22)00072-1

Clinician wire puncture injury to the hand from chest compressions on a patient with a median sternotomy: A case report: JEN. (2022). Journal of Emergency Nursing, 48(3), 253-256. doi:https://doi.org/10.1016/j.jen.2022.01.011

Standard precautions, including protections from blood and body fluid exposure, are designed to protect health care providers from infections. Sharps safety practices rarely include the potential for the unconscious patient's own body to be a potential source of clinician percutaneous injury from sharp objects outside of the perioperative setting. This case report reviews a percutaneous injury to the hand of a physician who was performing chest compressions on a patient with an out-of-hospital cardiac arrest. The 76-year-old patient in cardiac arrest had undergone a medial sternotomy surgery 15 years before the arrest. The sternal wire rotated owing to the initial chest compressions, breaking the clinician's nitrile glove and producing an open wound on the thenar region of the clinician's right hand. Application of a 10 × 10 12-ply gauze pack on the chest of the patient in cardiac arrest allowed the resuscitation team to continue with the compressions with no further wounds from the wire. This case report is a novel contribution to the published literature and advances standard precautions considerations in patients with out-of-hospital cardiac arrest, with the sternotomy wire from previous surgery as a source of percutaneous clinician injury during chest compression.

Table of contents: JEN. (2022). Journal of Emergency Nursing, 48(3) doi:https://doi.org/10.1016/S0099-1767(22)00069-1

Srinivasan, S. S. (2022). Respiratory care innovation in times of crisis: JEN. Journal of Emergency Nursing, 48(3), 250-252. doi:https://doi.org/10.1016/j.jen.2022.03.002

System-based modifications such as resistors, clamps, and valves have enabled varying levels of control in carefully matched patients.10,11 In addition, the ability to monitor, overcome ventilator self-tests, exposure, and alarms have been overcome by recent systems.11 Splitting high flow oxygen delivered by a mask or a nasal cannula is certainly less risky, although the rate of oxygen consumption would be increased without special valving leading to accelerated depletion of oxygen reservoirs. In 2021, insufficient oxygen reserves and widespread use for COVID-19 patients created drastic shortages, leading to increased mortality in India.12 Technologies to cost-effectively expand high-flow nasal oxygen systems without wastage would benefit health care infrastructures experiencing high caseloads.—Shriya S. Srinivasan, PhD, Department of Mechanical Engineering, Massachusetts Institute of Technology, Division of Gastroenterology, Hepatology and Endoscopy, Brigham and Women's Hospital, Harvard Medical School, David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology, Project Prana Foundation, Cambridge 02139, Boston 02115, MA, United States; E-mail: shriyas@mit.edu. Twitter: rajibmndl; Khalil B. Ramadi, PhD, Department of Mechanical Engineering and David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology; Division of Gastroenterology, Hepatology and Endoscopy, Brigham and Women's Hospital, Harvard Medical School; Project Prana Foundation, Cambridge 02139, MA, United States.

Emergency nurse certification: JEN. (2022). Journal of Emergency Nursing, 48(3), 299-302. doi:https://doi.org/10.1016/j.jen.2021.12.004

The nurse workforce consists of people with varying levels of education and experience in specialty areas.1 Nurses often seek to distinguish clinical and professional expertise through specialty certification.2,3 As the healthcare environment is becoming more complex, some healthcare leaders are advocating for specialty certification as a national standard to increase nurses' professional standing and prepare nurses to better meet the specific needs of the patient populations they serve.4 Board certification demonstrates excellence and recognition of the specialized knowledge, skills, and clinical judgement validated by the achievement of standards identified by nursing specialty to promote optimal health outcomes.5 The first large-scale, rigorous study examining the value of emergency nursing certification to nurses, their patients, and their employers, “The Value of Certification Study,” was conducted by the Human Resources Research Organization and commissioned by the Board of Certification for Emergency Nursing (BCEN).6 Study results were based on survey data from over 8,800 certified and non-certified emergency nurses and over 1,000 emergency supervisors. Previously, ENA has collaborated with stakeholders, including the American Academy of Emergency Nurse Practitioners (AAENP) and the National Association of Clinical Nurse Specialists, to further establish core competencies and expand opportunities for APRNs in the emergency setting.20,21 In 2019, the ENA Position Statement, Advance Practice Registered Nurses in the Emergency Setting, established the importance of APRNs in the ED setting and outlined gaps in national certifications.22 AAENP developed a strategic partnership with ENA to establish the emergency nurse practitioner (ENP) specialty scope and standards, thereby paving the way for professional certification mechanisms.17,23 Emergency nurse practitioners may attain an Emergency Nurse Practitioner Certification (ENP-C) through a program offered by the American Academy of Nurse Practitioners in collaboration with AAENP.24 For clinical nurse specialists (CNSs) who practice in the emergency setting, there is currently no emergency certification method for the CNS APRN role. ...]variations in practice, which take into account the needs of the individual patient and the resources and limitations unique to the institution, may warrant approaches, treatments and/or procedures that differ from the recommendations outlined in this position statement. ...]this position statement should not be construed as dictating an exclusive course of management, treatment or care, nor does adherence to this position statement guarantee a particular outcome.

Emergency evaluation of nonfatal strangulation patients: A commentary on controversy and care priorities: JEN. (2022). Journal of Emergency Nursing, 48(3), 243-247. doi:https://doi.org/10.1016/j.jen.2022.03.003

Both leave few marks, both can result in loss of consciousness, both are used to assert dominance and authority over the life of the other, both create intense fear and potentially result in death and both can be used repeatedly, often with impunity.2Poststrangulation Diagnostic Imaging Computed tomographic angiography (CTA) is considered the preferred screening test to evaluate cervical vasculature for blunt cerebrovascular injuries (BCVIs).13-15 However, determining which poststrangulation patients should receive CTA to maximize utility and minimize risk is a topic of controversy. Increased incidence of thyroid cancer has been observed in patients exposed to high-dose radiation from atomic weapons or nuclear power plant accidents. ...]there is continued discussion in the literature about whether or not the increased incidence of thyroid cancer is associated with or caused by increased use of diagnostic computed tomography scans. Radiation specific studies have calculated the estimated cancer risk from CTA of the neck to be a maximum of 36 cancers per 1,000,000 studies or 0.0036% for a single CTA.23 The authors of the Eastern Association for the Surgery of Trauma PMGs concluded that this risk was outweighed by the benefits of diagnosing BCVI using a liberal or universal CTA screening protocol.15 We are unaware of any existing research on the psychological burden CTAs pose to patients presenting after strangulation.

Providing hearing assistance to veterans in the emergency department: A qualitative study: JEN. (2022). Journal of Emergency Nursing, 48(3), 266-277. doi:https://doi.org/10.1016/j.jen.2022.01.005

IntroductionEffective communication is essential to good health care, and hearing loss disrupts patient-provider communication. For the more than 2 million veterans with severe hearing loss, communication is particularly challenging in noisy health care environments such as emergency departments. The purpose of this qualitative study was to describe patient and provider perspectives of feasibility and potential benefit of providing a hearing assistance device, a personal amplifier, during visits to an emergency department in an urban setting affiliated with the Department of Veterans Affairs.MethodsThis qualitative descriptive study was conducted in parallel with a randomized controlled study. We completed a semistructured interview with 11 veterans and 10 health care

providers to elicit their previous experiences with patient-provider communication in the ED setting and their perspectives on hearing screening and using the personal amplifier in the emergency department. Interview data were analyzed using content analysis and Atlas.ti V8.4 software (Scientific Software Development GmbH, Berlin, Germany).ResultsThe veteran sample (n = 11) had a mean age of 80.3 years (SD = 10.2). The provider sample included 7 nurses and 3 physicians. In the ED setting, hearing loss disrupts patient-provider communication. Screening for hearing loss in the emergency department was feasible except in urgent/emergent cases. The use of the personal amplifier made communication more effective and less effortful for both veterans and providers.DiscussionProviding the personal amplifier improved the ED experience for veterans and offers a promising intervention that could improve health care quality and safety for ED patient populations.

Analysis of a consecutive retrospective cohort of strangulation victims evaluated by a sexual assault nurse examiner consult service: JEN. (2022). Journal of Emergency Nursing, 48(3), 257-265. doi:https://doi.org/10.1016/j.jen.2022.01.001

ObjectiveThe purpose of this study was to review the evaluation of strangulation victims assessed by a sexual assault nurse examiner (SANE) service. The primary objective was to produce observational results on documented injury frequency and secondarily to explore advanced imaging use, outcomes, signs/symptoms, and documentation.MethodsThis was a retrospective analysis of a cohort of 130 consecutive strangled patients over a 42-month period evaluated by a SANE consult service in a metropolitan area. A single investigator extracted medical records for demographics, history, imaging, injuries, disposition, and both presence and documentation of a number of signs/symptoms. A second investigator independently extracted greater than 30% of the total charts with universal agreement. Data were analyzed with descriptive statistics.ResultsPatients were primarily female (129:1) and their age averaged 30.6 years. Time from event to presentation varied. There were no major brain or neck injuries detected (0%; 95 confidence interval, 0-2.31), and all patients were discharged in stable condition. Imaging was used in 23 patients (17.7%). Certain signs and symptoms were more common than others, and documentation frequency of signs and symptoms varied.ConclusionIn this retrospective cohort of 130 consecutive nonfatally strangled awake patients seen as SANE consults in a single emergency department, there were no major injuries documented. The most common signs or symptoms were neck pain, neck markings, and loss of consciousness. Imaging was used in 17.7% of the patients. Presence or absence of neck pain, neck markings, and altered mental status were most consistently documented. Seizure, subcutaneous emphysema, and carotid bruit were least consistently documented.

Recharging through advocacy and support of legislation: JEN. (2022). Journal of Emergency Nursing, 48(3), 235. doi:https://doi.org/10.1016/j.jen.2022.02.003

The Dr Lorna Breen Act helps to support this effort by having the US Department of Health and Human Services (DHHS) support grants that train health care providers on suicide prevention, other behavioral health issues, and strategies to improve well-being. ...]DHHS would be asked to establish or expand programs to promote mental and behavioral health among health care providers involved with COVID-19 response efforts. The second part of the law states that the DHHS will study and develop policy recommendations on preventing burnout and improving mental and behavioral health among health care providers, removing barriers to accessing care and treatment, and identifying strategies to promote resiliency.

Woman with left pulsatile exophthalmos: JEN. (2022). Journal of Emergency Nursing, 48(3), 317-318. doi:https://doi.org/10.1016/j.jen.2021.12.007

In the disease, there are skin, peripheral and central nervous system, bone, and soft tissue involvements, and there is an increase in the susceptibility to cancer.1 NF-1 is seen once in 3000 births, showing autosomal dominant inheritance and affecting many systems simultaneously.2 The NF-1 gene is located on chromosome 17 and encodes a type of tumor suppressor protein called neurofibromin. ...]of incomplete or incorrect folding of this protein, benign and rarely malignant nerve tumors are seen from the early stages of life. Because the disease affects many systems at the same time, the diagnostic criteria have been shaped in this direction. The magnetic resonance

angiography imaging temporal lobe was herniated anteriorly with the median cerebral artery, causing the orbital contents' forward shift (Figure 3). ...]we diagnosed the patient as having NF-1 with sphenoid wing dysplasia.Discussion In NF-1 disease, sphenoid wing dysplasia is seen in 5% to 10% of cases.

A cross-sectional geographic information systems study of a pediatric emergency department child restraint system distribution program: JEN. (2022). Journal of Emergency Nursing, 48(3), 278-287. doi:https://doi.org/10.1016/j.jen.2022.02.002

IntroductionA pediatric ED program sought to promote injury prevention through distribution of child restraint systems. Program funds are paid for child passenger safety technician certification of all personnel. Pediatric emergency nurses distributed child restraint systems at hospital discharge and dedicated technicians at fitting stations. Researchers described program characteristics, developed a baseline understanding of program outreach using geographic information systems, and evaluated adherence to manufacturer guidelines with a sensitivity analysis.MethodsThis retrospective cross-sectional study used distribution forms linked to hospital records from 2013 to 2016. Testing for differences used nonparametric methods. Median values and interquartile ranges for weight and height of children were compared with manufacturer guidelines. Geographic information systems visualized recipients' street addresses and motor vehicle crashes on an underlying base map.ResultsThere were 312 child restraint systems distributed: of which 179 (57.4%) at the hospital, 126 (40.4%) at fitting stations, and 7 (2.2%) missing a location. Among those on Medicaid, 64.4% received a child restraint system at the hospital compared with 35.6% at fitting stations ($\chi 2 = 5.40$, $P < .02$). Fitting stations had limited outreach to rural residents. Finally, results from the sensitivity analysis showed that devices were issued according to manufacturer guidelines.DiscussionDespite the workplace pressures of clinical care, pediatric emergency nurses delivered educational information and demonstrated hands-on installation at similar rates to dedicated technicians. Distribution of child restraint systems through the hospital reached a uniquely underserved population. Further research should investigate methods to improve fitting station outreach among Medicaid recipients.

Hypokalemic cardiac arrest: Narrative review of case reports and current state of science: JEN. (2022). Journal of Emergency Nursing, 48(3), 310-316. doi:https://doi.org/10.1016/j.jen.2021.12.008

PurposeHypokalemic cardiac arrest is an uncommon occurrence in the emergency department. Electrocardiogram findings related to hypokalemic cardiac arrest include prolonged QT, U waves, and preventricular contractions leading to Torsades de Pointes and then arrest. Literature evaluating the prevalence of hypokalemic cardiac arrest is scarce, and its management is lacking. This review provides a summary of current literature, recommendations from current guidelines, and proposed management strategies of hypokalemic cardiac arrest.SummaryIntravenous potassium administration is the treatment for hypokalemic cardiac arrest. Although the treatment for hypokalemic cardiac arrest is known, there is limited evidence on the proper procedure for administering intravenous potassium appropriately and safely. Owing to the time-sensitive nature of treating hypokalemic cardiac arrest, rapid administration of intravenous potassium (10 mEq/100 mL of potassium chloride over 5 minutes) is warranted. Concerns regarding rapid potassium administration are not without merit; however, a risk-benefit analysis and potential mitigation strategies for unwanted side effects need to be considered if hypokalemic cardiac arrest is to remain a reversible cause. It is imperative to identify hypokalemia as the cause for arrest as soon as possible and administer potassium before systemic acidosis, ischemia, and irreversible cell death.ConclusionsMore evidence is necessary to support treatment recommendations for hypokalemic cardiac arrest; however, it is the authors' opinion that, if identified early during cardiac arrest, intravenous potassium should be administered to treat a reversible cause for cardiac arrest.

NCPD earn up to X.X contact hours: JEN. (2022). Journal of Emergency Nursing, 48(3), 339. doi:https://doi.org/10.1016/S0099-1767(22)00087-3

Patient extrication process for urban emergency departments: JEN. (2022). Journal of Emergency Nursing, 48(3), 328-338. doi:https://doi.org/10.1016/j.jen.2022.01.012

ObjectivesThis project aimed to create and implement a safe and efficient role-based process to rapidly extricate traumatically injured persons transported to the emergency department via police transport or private vehicle.MethodsA simulation exercise was conducted with an interdisciplinary team of ED personnel, Philadelphia Police Department, and University of Pennsylvania police officers to identify the necessary steps to rapidly extricate traumatically injured individuals.ResultsThe simulation exercise identified several new processes needed to complete rapid extrications of traumatically injured individuals from private and police vehicles. These included a safe drop-off location, ED personnel role identification, proper personal protective equipment donning, 2 rapid extrication techniques, and a hard stop for weapon check by security before entering the emergency department.ConclusionsThrough simulation, the ED interdisciplinary team was able to develop a role-based safe and efficient rapid extrication process. Educating new ED personnel, security, and Pennsylvania police continues to facilitate ongoing safe rapid extrication practices in the emergency department.

Automated dispensing cabinet Overrides—An evaluation of necessity in a pediatric emergency department: JEN. (2022). Journal of Emergency Nursing, 48(3), 319-327. doi:https://doi.org/10.1016/j.jen.2022.01.007

ObjectiveAutomated dispensing cabinets, or ADCs, are often used at health care facilities to aid in the medication-use process. Although ADCs minimize certain medication errors, they introduce a new type of error involving overrides. Although helpful when used appropriately in emergencies, overrides bypass pharmacist verification and increase potential for patient harm through drug-drug interactions, medication allergies, inappropriate dosing, and more. The purpose of this study was to evaluate automated dispensing cabinets override pulls in a pediatric hospital's emergency department. The authors sought to discover whether overridden medications were being administered before verification (indicating it was needed emergently, thus justifying override) or after verification (indicating the override did not result in quicker administration and/or the medication was not emergent).MethodsThis was a retrospective, observational study. Data were collected from electronic health record reports from a 343-bed pediatric hospital's emergency department from October 13, 2019, to December 22, 2019.ResultsA total of 445 override pulls were identified during this time, and after data analysis, 99 override pulls remained in the data set. Overall, time from input of prescription into the electronic medical record to medication override was approximately 4 minutes. Pharmacist verification also took a median of four minutes after prescription input. However, administration took twice as long, at 8 minutes. On average, pharmacist verification occurred 4 minutes before medication administration.ConclusionThis research from a pediatric emergency department suggests that most situations did not require an immediate administration, and perhaps an override was unnecessary and could have been avoided.

A modified aerosol mask could significantly save oxygen supplies during SARS COV 2 pandemic: JEN. (2022). Journal of Emergency Nursing, 48(3), 248-250. doi:https://doi.org/10.1016/j.jen.2021.08.002

Of note, the World Health Organization recently published an interim guide on oxygen source and distribution during the COVID-19 pandemic, estimating that an average of 90 m3 of oxygen per hour would be necessary to cover the needs of a hospital managing 100 concurrent COVID-19 cases.2 Unfortunately, epidemic waves have put health care systems under stress, and oxygen supply scarcity has been encountered in some regions of the world, such as India, Africa and Latin America.3 Oxygen supply and oxygen-saving strategies are thus of utmost importance for those regions. In addition to hospital use, an online video tutorial (shared by a Quick Response-code on oxygen bottles) or documentation included with oxygen bottles could allow implementation of this simple device among the population for at-home care. In addition to saving oxygen, proper use of this device could have a significant economic impact on and reduce the risk of catastrophic health expenditure faced by families taking care of their relatives at home because of overwhelmed hospitals.—Duprez F, PT, RT, PhD, ICU Epicura Hospital Hornu Belgium and Laboratory of Motion and Respiratory Physiology Condorcet School, Tournai, Belgium; De Terwangne Ch, MD, PhDs, Deparment of Geriatric Medicine, Université Catholique de Louvain, Brussels, Belgium; Poncin W, RT, PhD, Service de Pneumologie, Cliniques; and secteur de Kinésithérapie et Ergothérapie, Cliniques Universitaires Saint-Luc, Brussels, Belgium; Bruyneel A, RN, CCRN, PhDs, Health Economics, Hospital Management and Nursing Research Department, School of Public Health, Université Libre de Bruxelles, Brussels, Belgium.

Editorial board: JEN. (2022). Journal of Emergency Nursing, 48(3) doi:https://doi.org/10.1016/S0099-1767(22)00070-8

Thank you to reviewers: JEN. (2022). Journal of Emergency Nursing, 48(2), A12-A14. doi:https://doi.org/10.1016/S0099-1767(22)00032-0

Infrared vein imaging for insertion of peripheral intravenous catheter for patients requiring isolation for severe acute respiratory syndrome coronavirus 2 infection: A nonrandomized clinical trial: JEN. (2022). Journal of Emergency Nursing, 48(2), 159-166. doi:https://doi.org/10.1016/j.jen.2021.10.001

IntroductionEstablishing intravenous access is essential but may be difficult to achieve for patients requiring isolation for severe acute respiratory syndrome coronavirus 2 infection. This study aimed to investigate the effectiveness of an infrared vein visualizer on peripheral intravenous catheter therapy in patients with coronavirus disease 2019.MethodsA nonrandomized clinical trial was performed. In total, 122 patients with coronavirus disease 2019 who required peripheral intravenous cannulation were divided into 2 groups with 60 in the control group and 62 in the intervention group. A conventional venipuncture method was applied to the control group, whereas an infrared vein imaging device was applied in the intervention group. The first attempt success rate, total procedure time, and patients' satisfaction score were compared between the 2 groups using chi-square, t test, and z test (also known as Mann-Whitney U test) statistics.ResultsThe first attempt success rate in the intervention group was significantly higher than that of control group (91.94% vs 76.67%, 2 = 5.41, P = .02). The procedure time was shorter in the intervention group (mean SD], 211.44 68.58] seconds vs 388.27 88.97] seconds, t = 12.27, P < .001). Patients from the intervention group experienced a higher degree of satisfaction (7.5 vs 6, z = −3.31, P < .001).DiscussionPeripheral intravenous catheter insertion assisted by an infrared vein visualizer could improve the first attempt success rate of venipuncture, shorten the procedure time, and increase patients' satisfaction.

Emergency nurses recognize a need for education of delirium prevention and management in the emergency department: JEN. (2022). Journal of Emergency Nursing, 48(2), 126-127. doi:https://doi.org/10.1016/j.jen.2021.10.005

Resources to fill gaps in knowledge and training include the geriatric ED guidelines, which recommend protocols to address delirium in the emergency department,4 and a recently published toolkit to aid emergency departments in implementing delirium programs, which includes educational materials for ED staff.5 Providing emergency nurses with appropriate support to address ED delirium is one critical component toward improving emergency care for older adults.—Anita N. Chary, MD, PhD, Department of Emergency Medicine, Department of Internal Medicine, Center for Innovations in Quality, Effectiveness and Safety, Baylor College of Medicine, 1 Baylor Plaza, Houston, TX 77030; E-mail: anita.chary@bcm.edu. Twitter: @EmilyWeaver_WHI, ORCID identifier: https://www.doi.org/0000-0003-4354-7797; Adriane Lesser, MS, MBA, West Health Institute, San Diego, CA.Twitter: @AdrianeLesser, ORCID identifier: https://www.doi.org/0000-0003-3226-5022; Sharon K. Inouye, MD, MPH, Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, and the Aging Brain Center, Marcus Institute for Aging Research, Hebrew SeniorLife, Boston, MA. Twitter: @GeriatricEDNews, ORCID identifier: https://orcid.org/0000-0002-2603-7157; Maura Kennedy, MD, MPH, Department of Emergency Medicine, Massachusetts General Hospital, Boston, MA and Harvard Medical School, Boston, MA.