Public Health of Indonesia
Pertami SB, et al. Public Health of Indonesia. 2017 August;3(3):89-95 ISSN: 2477-1570
http://stikbar.org/ycabpublisher/index.php/PHI/index

Original Research

EFFECT OF 30° HEAD-UP POSITION ON INTRACRANIAL PRESSURE CHANGE IN PATIENTS WITH HEAD INJURY IN SURGICAL WARD OF GENERAL HOSPITAL OF Dr. R. SOEDARSONO PASURUAN

Sumirah Budi Pertami*, Sulastyawati, Puthut Anami

Department of Nursing, Polytechnic of Health of Malang, Ministry of Health Republic of Indonesia

Accepted: 5 September 2017
***Correspondence:**
Sumirah Budi Pertami
Department of Nursing, Polytechnic of Health of Malang
Ministry of Health Republic of Indonesia
Jln. A.Yani No 1 lawang Malang
E-mail: sumirahbudip@yahoo.com

ABSTRACT

Background: Head-injured patients have traditionally been maintained in the head-up position to ameliorate the effects of increased intracranial pressure (ICP). However, it has been reported that the 15 degrees head-up position may improve cerebral perfusion pressure (CPP) and outcome. We sought to determine the impact of 30 and 15 degrees on intracranial pressure change.

Methods: This was a quasi-experimental study with posttest only control time series time design. There were 30 head-injured patients was selected using consecutive sampling, with 15 assigned in the treatment (30° head-up position) and control group (15° head-up position). Intracranial pressure variable was identified using the level of consciousness and mean arterial pressure parameters. Wilcoxon signed rank test was used for data analysis

Results: Findings showed p-value 0.010 (<0.05) on awareness level and p-value 0.031 (<0.05) on mean arterial pressure, which indicated that there was a statistically significant effect of the 30° head-up position on level of awareness and mean arterial pressure.

Conclusion: There was a significant effect of the 30° head-up position on intracranial pressure changes, particularly in the level of awareness and mean arterial pressure in patients with head injury. It is recommended that for health workers to provide knowledge regarding this intervention to prevent increased intracranial pressure.

Key words: Consciousness level, 30° head-up position, intracranial pressure, mean arterial pressure

BACKGROUND

Head injuries include injuries by objects/ bone fragments that penetrate brain tissue, and the effect of strength or energy being passed on to the brain or the effects of acceleration and deceleration on the brain.[1] According to literature, head injuries can cause serious problems such as increased intra-cranial pressure, crisis hypertension, bleeding, seizures and death. Increased intraranial pressure can lead to ischemia or

infarction of brain tissue and brain death so that immediate precautions are required.[2]

Traffic accidents are the most common cause of head injuries and are a public health problem worldwide, especially in developing countries.[3] This situation generally occurs in motor drivers without wearing helmet or wearing helmets carrelesly, and do not meet the standards.[3] Brain injury trauma is a significant global public health concern and is predicted to be the leading cause of death and disability by 2020.[4]

Every year, in the United States, it is about 30 million emergency injuries become hospital cases and cause death. Of those, 16% are head injuries as a primary and secondary diagnosis. In 2010, approximately 2.5 million people were hospitalized with a diagnosis of head injury in the United States.[5] In Asia, a high percentage of incidence of head injury is caused by fall (77%) and other injuries (57%).[4]

In Indonesia, the incidence of head injury each year is estimated to reach 500,000 cases, with 10% of them died before arriving at the hospital. Of all cases, 80% were classified as mild head injury, 10% as moderate head injury, and 10% as severe head.[6] According to medical record data of general hospital of dr. R. Soedarsono Pasuruan during the preliminary study, there were 115 cases of head injury on July - September 2016, with 94 patients categorized as mild head injury, 8 moderate head injury and 13 serious head injury patients.

Non-pharmacologic strategies performed for the management of head injury are the setting up of the 15-30° head-up position to improve venous return and reduce intra-cranial pressure. In patients with hypovolemic, there may be a suspicion of a drastic decrease in blood pressure and decreased cerebral perfusion.[7] In management to optimize the value of intra-cranial pressure, blood pressure is required to maintain the value of cerebral perfusion pressure within the normal range. In patients with severe head injury, hypotension may increase death. While in patients with head injury, hypertension also occurs that can cause death. The 30° head-up position is suggested according to previous studies, which can decrease ICT and increase the pressure of cerebral perfusion compared to the supine position.[8]

A 30° head-up position is performed in patients with head injury because this position will facilitate drainage of reverse blood flow from intracranial so as to reduce intracranial pressure.[2] In addition, from the Mahfoud study,[9] it was found that intracranial pressure in ICT values decreased significantly in the 0°-60° position range, minimum intracranial arterial pressure was found in patients with a 30° head-up position. Horizontal position will increase CPP and head-up position >40° will decrease brain perfusion.[8] Bahrudin and Sunardi[10] also stated that ICT will decrease significantly from 0°-35° head-up position, but in 40° position and upwards, ICT will rise again.

Therefore, this study aimed to analyze the effect of the 30° head-up position on changes in intracranial pressure in patients with head injury. The study was conducted by observing the level of awareness and Mean Arterial Pressure (MAP) to identify changes in intracranial pressure.

METHODS

Design

This was a quasi-experimental study with posttest only control time series time design.

Research subjects

The target population in this study was all patients with head injury in the surgical

ward of the general hospital of Dr. R. Soedarsono Pasuruan. There were 30 head-injured patients was selected using consecutive sampling, with 15 assigned in the treatment and control group.

Intervention

The researcher performed a 30° head-up position to the treatment group and the 15° head-up position to the control group to obtain relevant data in accordance with the research objectives. The treatment of this position arrangement was performed when the patient was treated in the surgical ward. The treatment was given for 2 hours on the first day and then the level of awareness and Mean Arterial Pressure was measured (posttest 1). After than, the treatment was continued for 2 hours and then the level of awareness and Mean Arterial Pressure was measured again (posttest 2).

Instrument

Level of awareness and mean arterial pressure were measured in this study. Level of awareness was measured using GCS instruments (Glasgow Coma Scale) to describe intracranial pressure. GCS 9 -12 refers to moderate intracranial pressure increase, and GCS 13-15 refers to 13-15. While Mean Arterial Pressure or average of arterial pressure was calculated by measuring blood pressure then counting systole multiply diastole and divided by three. Measurement of Mean Arterial Pressure to explain the intracranial pressure in this study was categorized into 3 classes: High if MAP >100 mmHg, normal if MAP in the range 70 - 100 mmHg, and low if MAP <70 mmHg.

Research Ethics

Ethical approval was obtained from the Health Research Ethics Commission at Poltekkes Kemenkes Malang. Study permission was obtained from the General Hospital of Dr. R. Soedarsono Pasuruan to carry out research by disseminating the intent and purpose of research. The researcher explained the objectives and procedures of the study, and asked for the patient's willingness to be the respondent in the study and signed the informed consent.

Data analysis

Wilcoxon signed rank test was used for data analysis because the result of normality test using Shapiro Wilk showed <0.05, which indicated that the data were not in normal distribution.

RESULTS

Characteristics of respondents

Table 1 shows that 33.3% of patients with head injury aged 15-25 years, 30% of them aged 26-35%, and the rest aged 36-65 years. The majority of respondents were male (60%), having head injury caused by motor vehicle accidents (73.3%), and 83.3% of them had mild head injury.

Table 1. Distribution of respondents based on age, gender, cause of head injury, head injury classification

Characteristics	n	%
Age		
15 – 25	10	33.3%
26 – 35	9	30%
36 – 45	2	6.67%
46 – 55	5	16.67%
56 – 65	4	13.33%
Gender		
Male	18	60%
Female	12	40%

Cause of head injury		
Motor vehicle accidents	22	73.3%
Work-related accidents	2	6.7%
Falls	4	13%
Blunt trauma	2	6.7%
Classification		
Mild head injury	25	83.3%
Moderate head injury	5	16.67%

Table 2. Average level of awareness and mean arterial pressure

Variables	n	Mean	SD
Level of Awareness			
30° *Head-up position*			
Posttest 1	15	13.67	1.44
Posttest 2	15	14.87	0.32
15° *Head-up position*			
Posttest 1	15	14.40	0.91
Posttest 2	15	14.60	0.91
Mean Arterial Pressure (MAP)			
30° *Head-up position*			
Posttest 1	15	80.42	18.5
Posttest 2	15	93.76	5.57
15° *Head-up position*			
Posttest 1	15	85.01	15.3
Posttest 2	15	81.05	15.4

The result of the awareness level on the 30° head-up position in 15 respondents in posttest 1 showed that 26.67% of respondents had awareness level 9-12 and 73.33% of them had awareness level 13-15. In posttest 2, it was 100% of respondents had awareness level ranged 13-15. Table 2 shows that the mean level of awareness in posttest 1 was 13.67 and in posttest 2 was 14.87. While the level of awareness on the 15° head-up position, the mean of awareness level in posttest 1 was 14.40 and in posttest 2 was 14.60. For the mean arterial pressure, in the 30° head-up position, MAP in the posttest 1 was 80.42 and posttest 2 was 93.76. While in the 15° head-up position, MAP in the posttest 1 was 85.01 and posttest 2 was 81.05.

Table 3. Effect of the 30° head-up position on intracranial pressure changes using Wilcoxon signed rank test

Level of Awareness	P-value
30° *Head-up position* *Posttest* 1 *Posttest* 2	0.010*
15° *Head-up position* *Posttest* 1 *Posttest* 2	0.083
Mean Arterial Pressure (MAP)	
30° *Head-up position* *Posttest* 1 *Posttest* 2	0.031*
15° *Head-up position* *Posttest* 1 *Posttest* 2	0.035*

**Significant level (<0.05)*

Wilcoxon signed rank test as shown in the Table 3 showed p-value 0.010 (<0.05), which indicated that there was a statistically significant effect of the 30° head-up position on level of awareness compared to the 15° head-up position. However, there were statistically significant effects of both 30° and 15° head-up position on mean arterial pressure with p-value 0.031 and 0.035 (<0.05).

DISCUSSION

This study aimed to analyze the effect of the 30° head-up position on changes in intracranial pressure in patients with head injury. Intracranial pressure was described in terms of awareness level and mean arterial pressure. Findings of this study revealed that there was a statistically significant effect of the 30° head-up position on level of awareness. This is in line with previous study found that 93.3% of patients post-op trepanation had composmentis awareness after given 30° head-up position in 30 minutes.

The 30° head-up position aims to secure the patient in the fulfillment of oxygenation in order to avoid hypoxia in the patient, and intracranial pressure may be stable within the normal range.[11] In addition, this position is more effective to maintain the level of consciousness because it affects the anatomical position of the human body which then affects the patient's hemodynamics. The 30° head-up position is also effective for brain homeostasis and prevent secondary brain damage by respiratory function stability to maintain adequate cerebral perfusion.[12]

Findings of this study also revealed that there was statistically significant effect of both 30° and 15° head-up position on mean arterial pressure. This is consistent with previous study indicated that head-up position in the range 15-30° could decrease cerebral perfusion pressure and stabilize mean arterial pressure.[8] The Mean Arterial Pressure (MAP) variable was measured in this study because of the particularity of the clinical symptoms in head injury namely decreased level of consciousness and change in blood pressure. Besides, MAP is used in the formula: *Cerebral Perfusion Pressure = Mean Arterial Pressure - Intracranial Pressure*.[10] Cerebral Perfusion Pressure is the pressure of brain perfusion, which is related to the intracranial pressure.

On the other hand, Olviani[8] states that Mean Arterial Pressure should be maintained above 60 mmHg to ensure perfusion to the brain, coronary artery and kidney during head-up position. In addition, an increase in blood pressure or enlarged pulse pressure (the difference between systolic and diastolic blood pressure) or changes in vital signs is a clinical symptom of increased intracranial pressure.[12] Changes in systole and diastole will also affect the value of mean arterial pressure in patients with head injury.

Positioning is one of the familiar forms of nursing intervention in the application of patient care. The 30° head-up position is part of progressive mobilization of level I in head-injured patients who can be non-pharmacological techniques to maintain intracranial pressure stability. The 30° head-up position can launch venous drainage from the head and stable condition; and prevent neck flexion, head rotation, cough and sneeze.

However, the effect of the 30° head-up position on intracranial pressure is influenced by many factors include drug factors, history of hypertension and other nonpharmacological techniques. Drug factors are excluded in this study due to the researchers limitations in controlling the half-life of the drug, and the other confounding factors such as prior history of disease were also excluded because in

the study there were no respondents with prior history of hypertension.

At the time of the study, some patients were not able to tilt to one side of the body so that this limitation affected the progressive mobilization of level I for head injury patients. In addition, in this study, the researcher also had a limitation in managing pharmacological treatment that might impact on intracranial pressuree, such as sedation with morphine IV, tracheal intubation, mechanical hyper-ventilation (PaCO2<30 mmHg), hyperosmotic drugs (manitol 0.25-0.5 g / kg), diuretics (furosemide 5-20 mg), paralysis (pancuronium 1-4 mg) and LCS drainage.[7] However, this study provides the insight of knowledge regarding the effect of the 30° head-up position on intracranial pressure change.

CONCLUSION

It can be concluded that there was a significant effect of the 30° head-up position on intracranial pressure changes, particularly in the level of awareness and mean arterial pressure in patients with head injury. It is recommended that for health workers to provide knowledge regarding this intervention to prevent increased intracranial pressure. Further study is needed to examine the 30° head-up position on intracranial pressure, in cluding pulse rates, breathing, pain level, vomiting and pupillary response.

REFERENCES

1. Grace PA, Borley NR. At a glance ilmu bedah. *Edisi ketiga. Jakarta: Penerbit Erlangga.* 2006.
2. Japardi I. Pemeriksaan dan Sisi Praktis Merawat Pasien Cedera Kepala. *Jurnal Keperawatan Indonesia.* 2003;7(1):32-35.
3. Riyadina W, Subik IP. Profil keparahan cedera pada korban kecelakaan sepeda motor di Instalasi Gawat Darurat RSUP Fatmawati. *Universa Medicina.* 2016;26(2):64-72.
4. Puvanachandra P, Hyder AA. The burden of traumatic brain injury in Asia: a call for research. *Pak J Neurol Sci.* 2009;4(1):27-32.
5. Frieden TR, Houry D, Baldwin G. Report to Congress on Traumatic Brain Injury in the United States: Epidemiology and Rehabilitation: National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention. Atlanta, GA. ; 2015.
6. Clarinta U, Iyos RN. Cedera Kepala Berat dengan Perdarahan Subraknoid. *Journal Medula Unila.* 2016;4(4):188-193.
7. Dunn LT. Raised intracranial pressure. *Journal of Neurology, Neurosurgery & Psychiatry.* 2002;73(suppl 1):i23-i27.
8. Olviani Y. PENGARUH PELAKSANAAN MOBILISASI PROGRESIF LEVEL I TERHADAP NILAI MONITORING HEMODINAMIK NON INVASIF PADA PASIEN CEREBRAL INJURY DI RUANG ICU RSUD ULIN BANJARMASIN TAHUN 2015. *Caring.* 2015;2(1):37-48.
9. Mahfoud F, Beck J, Raabe A. Intracranial pressure pulse amplitude during changes in head elevation: a new parameter for determining optimum cerebral perfusion pressure? *Acta neurochirurgica.* 2010;152(3):443-450.
10. Bahrudin M. Posisi Kepala Dalam Stabilisasi Tekanan Intrakranial. 2016.

11. Khandelwal N, Khorsand S, Mitchell SH, Joffe AM. Head-elevated patient positioning decreases complications of emergent tracheal intubation in the ward and intensive care unit. *Anesthesia & Analgesia.* 2016;122(4):1101-1107.
12. Batticaca FB. Asuhan keperawatan pada klien dengan gangguan sistem persarafan. *Jakarta: Salemba Medika.* 2008.

Cite this article as: Pertami SB, Sulastyawati, Anami P. Effect of 30° Head-Up Position on Intracranial Pressure Change in Patients with Head Injury in Surgical Ward of General Hospital of Dr. R. Soedarsono Pasuruan. Public Health of Indonesia 2017;3(3):89-95