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The Impact of 30-Degree Head-Up Position on Cerebral Perfusion in Moderate Brain Injury Patients

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ABSTRACT

Background: Nursing problems in brain injury patients include the risk of ineffective perfusion due to reduced oxygen flow to the brain, which, if not treated immediately, will increase intracranial pressure (ICP). One way to increase ICP is with 30-degree head-up position intervention. **Objective:** This study aimed to analyze the application of 30-degree Head Up Position on Cerebral Perfusion in Moderate Brain Injury Patients. **Method:** This research is an observational study with a case study design. Primary data was obtained through anamnesis and physical assessment with a sample of a patient being treated in the Hospital by assessing the effect of the 30-degree head-up position carried out for 30 minutes for 3 consecutive days. **Results:** In this study, the results showed an increase in cerebral perfusion as indicated by cerebral perfusion indicators, namely blood pressure, MAP, pulse, patient breathing improved, and the patient's level of consciousness increased until the final evaluation. **Conclusion:** From the results of the innovation analysis in this case, providing a 30-degree head-up position in patients with a risk of ineffective cerebral perfusion is one form of effectiveness in increasing the patient's cerebral perfusion so that it can prevent an increase in intracranial pressure.

Keywords: Brain Injury, Cerebral Perfusion, Head Up Position

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I. INTRODUCTION

Brain injury is an injury to the head that causes impaired brain function, which can be caused by a sudden, hard blow or impact or when an object penetrates the skull and enters the brain tissue (American Association of Neurological, 2020). In

Indonesia, the incidence of head injuries is increasing every year, with a higher prevalence in males than females under the age of 25 years; injuries are the third most commonly affected body part due to traffic accidents after extremities, leaving permanent scars and disrupting the quality

of life of sufferers (RISKESDAS, 2018). Researchers chose this topic so that many parties would know about the problem being studied, considering that the incidence of brain injuries is high every year.

In the United States, head injuries due to accidental falls are the highest incidence, namely 52.3%. In comparison, head injuries due to motor vehicle accidents occur in 20.4% of all patients with diagnosed head injuries (Peterson et al., 2019). The prevalence of head injuries in Indonesia reached 11.9%; the highest data was recorded in Gorontalo Province, with 17.9% of cases, and East Java reached 11.12% of cases (RISKESDAS, 2018). The number of head injuries in Jember Regency reached 12.5% of cases, 109 cases were recorded at the Hospital B in Jember, and the 109 cases varied from mild to moderate to severe head injuries.

It is estimated that by 2030, head injuries will be the leading cause of death and disability (Rosyidi et al., 2019). Nursing problems in brain injury patients include the risk of ineffective cerebral perfusion due to reduced oxygen flow to the brain, which, if not treated immediately, will increase intracranial pressure (ICP). Interventions that can be performed in brain injury cases are

positioning the patient in a head-up position (Markam, 2018).

Head-up intervention can reduce intracranial pressure, thereby affecting cerebrovascular dynamics, which can meet the demand for oxygen in the brain. The head-up position can increase blood flow in the brain to maximize cerebral oxygenation (El Mokadem & El-Sayed, 2020). There was a significant change in the patient's MAP, RR, and systolic/diastolic BP after 30 minutes in a 30-degree head-up position (El-meaty et al., 2017). Another study reported that an increase in head up higher than 30-degree increased intracranial pressure (Altun Uğraş et al., 2018). Head-ups facilitate drainage of blood flow back from the intracranial to reduce intracranial pressure (Ginting et al., 2020). Intracranial pressure will decrease significantly from the head-up position 0-degree until 30-degree, but at 40-degree and above, ICP will rise again (Pertami et al., 2017). Based on the description in the background above, researchers are interested in conducting clinical research by giving a 30-degree head-up position to patients with a risk of ineffective cerebral perfusion with cases of moderate brain injury at Hospital B in Jember to help maintain intracranial pressure and cerebral perfusion pressure in the desired range.

2. METHODS

This research is observational, with a case study design using a nursing care process approach. Research was held on January 2023 in the medical ward of the Hospital B in Jember, Indonesia. This study uses primary data analysis obtained through anamnesis and physical examination and secondary data analysis from patient medical records. This implementation is given once per shift for 30 minutes on three consecutive days from 17 to 19 January 2023.

3. RESULTS

The patient is female and 68 years old and came to the hospital on January 13, 2023, at 9 PM with the main complaint of the patient experiencing a decrease in consciousness. The patient was referred from the health center with complaints of decreased consciousness after having an accident at 6 PM when his younger sibling was carrying him. The patient was not wearing a helmet and then bounced forward. Prior to being taken to the hospital, the patient vomited twice. The patient arrives at the emergency room at 10 PM with vital sign examination results: BP 118/74 mmHg, Pulse 77 times/minute, RR 20 times/minute, GCS E2V3M4, SpO₂ 97%, body temperature 36°C. The patient was taken to the operating room for EDH

evacuation trepanation on January 14, 2023, at 4 PM, and the procedure was finished at 20.00. The patient was immediately transferred to the Intensive Care Unit at 8 PM. The results of the vital signs RR 14 times/minute, SpO₂ 100% with the help of a ventilator BPAP mode FiO₂ 32% pins 12 ASB 16 Peep 5 RR 14, BP 170/97 mmHg, N 95 times/minute, GCS sedated. After improving the patient's general condition, he was moved to the medical ward to an examination of vital signs was carried out with the results of BP: 130/80 mmHg, pulse 78 times/minute, RR: 20 times/minute, SpO₂ 97%, GCS E3V4M4, the patient looked weak, warm acral, post-op wound on the parietal part of the head with a stitch size of 21 cm, the condition of the dressing is clean, no blood seepage.

Researchers manage the 30-degree head-up position in dealing with cerebral perfusion problems in patients once per shift for 30 minutes on three consecutive days on January 17-19, 2023. The action is carried out with the assistance of nurses and families to ensure families can do it independently. The head-up position of 30-degree is a position to raise the head of the bed at an angle of about 30-degree. The body is in parallel position, so can reduce intracranial pressure and increase oxygen to the brain.

Table 1. Result of implementation

Component	Day 1		Day 2		Day 3	
	Before	After	Before	After	Before	After
Blood pressure (mmHg)	140/115	130/90	140/100	130/80	130/90	120/90
MAP (mmHg)	136	103	113	96	103	100
Pulse (times per minutes)	121	115	118	100	101	80
Respiration rate (times per minutes)	22	20	20	18	18	18
Light reflex (left and right eyes)	+/+	+/+	+/+	+/+	+/+	+/+
Pupilar reflex (left and right eyes)	2/2	2/2	2/2	2/2	2/2	2/2
Level of consciousness (GCS: eyes, Verbal, and Motoric)	3/4/4	3/4/4	3/4/5	3/4/5	4/4/5	4/5/5

MAP: Mean arterial pressure

From the table above, after intervention for three consecutive days, there were changes in cerebral perfusion in patients with indicators of blood pressure, MAP, pulse, and patient respiration improving, and the patient's level of consciousness increased until the final evaluation. Based on the results of the presentation above show that giving a 30° head has an impact on increasing cerebral perfusion in head-injured patients where there are differences before.

4. DISCUSSIONS

Brain injuries can cause physical, psychological, and even fatal changes. Patients with brain injuries may lose consciousness due to bleeding in the head. If there is bleeding in the head, it can cause

a hematoma, which causes an increase in intracranial pressure. The therapeutic position of the head-up has been proposed as a simple and effective way in brain-injured patients because it benefits brain physiology (El Mokadem & El-Sayed, 2020). There was a significant change in the patient's Mean Arterial Pressure, Respiration Rate, and systolic/diastolic blood pressure after 30 minutes in a 30° head-up position (El-moaty et al., 2017). Other studies reported that increasing head up higher than 30-degree decreased cerebral perfusion (Altun Uğraş et al., 2018).

Providing this intervention can lower intracranial pressure, thus affecting cerebrovascular dynamics, which can meet oxygen demand in the brain. The head-up

position can increase blood flow in the brain to maximize cerebral oxygenation (El Mokadem & El-Sayed, 2020). This position can reduce ICP so that the oxygen supply to the brain will increase (Riberholt et al., 2022). Increased oxygen in the brain can increase metabolism, characterized by increased awareness and other vital signs. This position is considered adequate because it corresponds to the anatomical position of the human body (Wahidin & Supraptini, 2020). The head-up position of 30° can reduce ICP to facilitate venous blood flow in the brain and create an adequate oxygen supply, reduce headaches, overcome nausea and vomiting, and stabilize blood pressure. Providing a 30-degree head-up position can reduce intracranial pressure and increase the awareness of patients with head injuries (Nurfajri & Yunanto, 2023), (Abdullah et al., 2022).

Researchers assume that a head-up of 30° can reduce ICP and improve venous blood flow in the brain so that oxygen can be adequate and blood pressure stable, so giving a head-up of 30° in head-injured patients effectively administered to overcome the risk of ineffective cerebral perfusion in patients. In the opinion of the investigators, a head-up of 30° in a head-injured patient may improve venous flow, allowing sufficient oxygen to reach the

brain and, therefore, may improve the patient's cerebral perfusion.

Our study has several limitations. Firstly, there was only one patient, although the number of comprehensive assessments collected may offset this. Second, this intervention is performed in stable patients without evidence of severe cerebral hypoxia or uncontrolled intracranial hypertension. Therefore, our findings must be validated in patients with more severe conditions. Indeed, previous studies have reached opposite conclusions regarding the impact of head elevation on brain perfusion in patients with Moderate Brain Injury versus Severe Brain Injury (Petersen, 2016). Therefore, head position to control Brain Injury should be viewed as a way to restore cerebral perfusion and then adjusted based on the results of direct measurements of cerebral oxygenation and circulation.

5. CONCLUSION

The evaluation results found that giving a 30-degree head-up position increased cerebral perfusion but not significantly. Providing a head-up position of 30-degree for patients with a risk of ineffective cerebral perfusion is one form of effectiveness in increasing cerebral perfusion to prevent an increase in intracranial pressure in patients.

Limitations of the literature on previous research results are still not enough. So, the results of this research have many weaknesses, both in terms of research results and analysis.

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AUTHOR CONTRIBUTIONS

Substantial contributions to conception, data collection, and analysis: Pinky Issabella Nanda Basuki, Siswoyo, Rondhianto and Mustakim. Writing manuscript and revisions: Pinky Issabella Nanda Basuki and Siswoyo.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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