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The Effect Of 30-Degree Head Elevation In Patients With Post-Craniotomy Sol Diagnosis On Improving Cerebral Tissue Perfusion In The Intensive Care Unit (ICU)

Nova Nova[1], Hikmat Pramajati[2], Nenden Rostini Hidayat[3]
[1, 2]Nursing Profession Study Program, Indonesia University of Education
[3]Clinical Instructor Hospital Umar Wirahadikusumah
nova@upi.edu, hikmatpramajati@upi.edu, nendenrostini200@gmail.com

Abstract

Intracranial Space Occupying Lesion (SOL) after craniotomy poses a risk of impaired cerebral perfusion due to increased intracranial pressure (ICP). One of the non-invasive interventions is the 30° head elevation position. This study aims to determine the effect of 30-degree head elevation position on improving cerebral tissue perfusion in post-craniotomy SOL patients. The method used is Case Report evidence-based nursing care on one patient in the ICU at Umar Wirahadikusumah Hospital. The 30° head elevation intervention was carried out for four days, each 2 hours per day, with monitoring of GCS, MAP, and oxygen saturation. The results showed an improvement in consciousness status from GCS E4M5V4 to E4M6V5, a decrease in MAP from 123 mmHg to 93 mmHg, and an increase in SPO^2 from 90% to 97%. It was concluded that 30° head elevation was effective in increasing cerebral perfusion, decreasing ICP, and improving the patient's neurological condition. This intervention is recommended as a standard procedure in critical care nursing for post-craniotomy patients.

Keywords: *Head Elevation 30^o, Cerebral Tissue Perfusion, Post Op Craniotomy, Space Occupying Lesion (SOL)*

✉ Corresponding author :Address : Jl. Desa Licin, Kec. Cimalaka, Kab. Sumedang Jawa Barat Email : hikmatpramajati@upi.edu
Phone : 08132288700

INTODUCTION

Intracranial Space Occupying Lesion (SOL) is a pathological disorder in the form of a mass that occupies space in the cranial cavity and can cause an increase in intracranial pressure (ICP). This condition requires craniotomy as a surgical intervention to remove the mass or lesion (Greenberg, 2020). Globally, the incidence of intracranial SOL ranges from 10-15 cases per 100,000 population, with primary brain tumors accounting for approximately 30% of intracranial SOL cases (Gore et al., 2022; Zumel-Marne et al., 2020). Studies conducted by Hanak et al (2015); Iaccarino et al (2021) reported that in 185 Post Craniotomy patients About 21% experienced ICP fluctuations and within 48 hours post-craniotomy, 40-60% of TBI patients experienced ICP >20 mmHg and most required aggressive management. Patients require advanced interventions to overcome the increase in ICP.

In Indonesia, intracranial SOL cases show a high prevalence with the incidence of brain tumors as one of the causes of SOL reaching 3-5 cases per 100,000 population per year (Ministry of Health, 2022). Data from the West Java Provincial Health Office shows that craniotomy for intracranial SOL cases is performed in approximately 250-300 cases annually at the main referral hospital, with an increase of roughly 8% per year in the last five years (Dinkes Provinsi Jawa Barat, 2023).

Patients with a diagnosis of Space occupying lesion (SOL) in the brain after craniotomy are included in the critical category because they are very vulnerable to cerebral perfusion disorders due to increased intracranial pressure (ICP) and compression of brain tissue caused by pathological masses such as tumors, hematomas, abscesses, or edema. These disorders cause cerebral blood flow (CBF) and cerebral perfusion pressure (CPP) to decrease, so that the supply of oxygen and nutrients to neurons is hampered and can lead to ischemia and neuronal cell death (Philipp et al., 2024). As a result, post-craniotomy patients are at high risk of neurological complications that result in decreased cognitive and motor function, with impaired cerebral perfusion being one of the main complications closely associated with increased ICP (Guo et al., 2022). This is in line with the findings of Gopalakrishnan et al (2018) who stated that post-operative ICP elevation often leads to significant neurological deficits due to disruption of cerebral blood flow and perfusion.

This disorder affects vital neurological functions and has a direct impact on the fulfillment of basic human needs, especially the physiological need for adequate oxygenation and circulation. When cerebral perfusion is compromised, patients may experience decreased consciousness, impaired motor function, and respiratory failure. This leads to the patient's complete dependence on ventilatory support and other intensive care in the ICU (Philipp et al., 2024). In addition, the fulfillment of the need for security and comfort is also impaired due to post-operative pain, immobilization, and communication limitations. A study by Alkhimova (2019) stated that physiologically, the brain requires stable perfusion to maintain nerve cell function. However, the presence of SOL leads to impaired blood flow through mechanical compression of cerebral blood vessels and changes in cerebrospinal fluid dynamics, suggesting that interference in the detection of cerebral perfusion may result in inaccurate assessment of cerebral blood flow status, thus worsening patient prognosis.

One simple but very important intervention to reduce ICP and improve cerebral perfusion is 30- degree head elevation. This intervention facilitates cerebral venous drainage and lowers intracranial pressure without significantly lowering perfusion pressure (Septania et al., 2023). With the head in a higher position than the heart, venous return to the heart is increased, preventing blood stasis in the brain and improving arterial blood flow to cerebral tissues (Arbour, 2013)

Research on 30-degree head elevation has been widely conducted including research conducted by Szczygielski et al (2023) maintaining the elevation head position for a longer period, for 2 hours contributed to a decrease in brain edema, improved perfusion, and faster neurological recovery, compared to only being done for a short time. The physiological mechanism underlying these findings is the improvement of more stable venous return and reduction of vascular compression over a longer period. This position also helps to reduce the need for mechanical ventilation and decrease the duration of ICU stay. In line with this study Septania et al (2023) showed that giving a 30-degree head position in post-craniotomy SOL patients was effective in reducing head pain and supporting increased cerebral perfusion. The latest research conducted by Pertami et al (2017) states that there is a significant effect of 30 ° head elevation position on changes in intracranial pressure, especially on the level of consciousness and mean arterial pressure in patients with head injuries. It is recommended for health workers to provide knowledge about this intervention to prevent increased intracranial pressure.

The results of a preliminary study conducted by researchers in April 2025 showed that there were 6 post-craniotomy patients admitted to the ICU room of Umar Wirahadikusumah Hospital during the period

January to March 2025. This finding shows that the case of post-craniotomy patients who are intensively treated is relatively significant, and from the results of interviews that at Umar Wirahadikusumah Hospital there is no SOP regarding Head Elevation of 30 degrees, so it requires the creation of SOP and special attention in clinical management, especially related to aspects of cerebral perfusion. Therefore, a comprehensive understanding of the
effect of a 30-degree head elevation position on cerebral tissue perfusion in post-craniotomy SOL patients is very important for optimizing care in the ICU room.

METHOD

This research is a qualitative descriptive case report with a nursing care approach that applies evidence-based practice nursing (EBPN). The research process begins with determining the problem that will be used as a topic, namely the risk of cerebral perfusion. This research will be conducted at Umar Regional General Hospital (RSUD) Wirahadikusumah Sumedang, Jalan Prabu Geusan Ulun No. 41, Kotakulon, South Sumedang District, Sumedang Regency, West Java Province, Postal Code 45311. This research uses nonprobability sampling. Nonprobability sampling is a sampling technique by not give the same probability to all members of the population. The type of nonprobability sampling used is the purposive sampling technique. Purposive sampling is a way of determining the sample due to certain considerations (Sugiyono, 2023). The population in this study were patients with Space Occupying Lesion (SOL) post-OP Craniotomy. Researchers also determine inclusion criteria. The criteria needed are as follows:
Inclusion Criteria:
1) Age> 40 years
2) Male or female gender
3) Medical diagnosis of Space Occupying Lesion
4) Craniotomy surgery has been performed
5) Hospitalized in the ICU of RSUD Umar Wirahadikusumah.

The research work is divided into three method, preparation, implementation and post intervention. First, the Preparation Stage. patients who meet the inclusion criteria will receive the EBN intervention application. At this stage, patients received an explanation of the procedure, purpose and benefits of the intervention as well as consent from patients and families.

Second Implementation Stage. The implementation stage in the application of EBN consists of three stages, namely pre intervention, intervention and post intervention. Pre intervention stage includes: After obtaining approval from Umar Wirahadikusumah Hospital. the author discussed the SOP with the nurses in the ICU room. After that, interviewing and conducting physical examinations on patients who have individual inclusion criteria and explaining the procedures, objectives and benefits of implementing EBN as well as giving consent to patients. Furthermore, checking the patient's health records or medical records and conducting an assessment of the patient regarding neurological status, checking the level of consciousness using the GCS scale (Glasgow Coma Scale), checking vital signs (TTV), namely systole and diastole blood pressure, heart rate, respiration rate, SPO^2, MAP based on measurements from the bedside monitor which are compared with manual measurements. The intervention stage includes: thepatient is positioned at 30 degrees head elevation for 2 hours for intervention carried out for 4 consecutive days on the morning shift from February 27, 2025 - March 02, 2025. Third, Post intervention stage includes: Assessment of the patient's vital signs after administration of the intervention including blood pressure, GCS, MAP, Heart Rate, Respiration Rate, Temperature and SPO^2 was performed daily on the morning shift for 4 consecutive days.

Data obtained from interviews, nursing care observations, head to toe physical examinations, patient medical records, to documentation in the form of photos of supporting examinations and provision of interventions must be grouped. Data grouping uses the nursing care format Critical Nursing Education Professional Ners University of Education Indonesia Campus in Sumedang. Reading the data thoroughly helps in preventing bias or repetitive data writing. Then pouring about cases and topics by describing in more detail and detail. Finally, narrate the findings. In this section, researchers must find many and complete references from previous studies. This is necessary so that researchers find comparisons between previous papers/research and their research (Kusumawardani et al., 2015).

RESULT AND DISCUSSION

Case Description

Pre-Arrival Assessment The client from the OK Postoperative Craniotomy room, came with decreased consciousness (DPO), cold acral, anemic conjunctiva (+), E1 M1 V1, Pupils 3/3 +/+ isochor, using a ventilator, RR 12X / Minute, SPO^2 100%, installed CVC 3 lumen right sub clavian location. On arrival assessment obtained data that the general condition of DPO, no airway obstruction, installed CPAP mode ventilator, Setting PS 5, PEEP 5, FiO2 50%, RR 12x / min, SPO^2 100%, Pale, cold acral, strong pulse, installed drain hose on the head, installed Ventilator and installed CVC 3 lumen right sub

clavian location. A comprehensive assessment conducted by researchers on 27/02/2025 obtained data on female patients, initials Mrs. Y, 46 years old, admitted to the ICU with a medical diagnosis after craniotomy due to supratentorial SOL in the left frontotemporoparietal lobe. At the time of assessment, the patient was conscious after sedation with the main complaint of spinning dizziness, accompanied by pain in the surgical area, slight tightness, and visual hallucinations (seeing something flying on the ceiling). Physical examination showed GCS E4 M5 V4, blood pressure 166/102 mmHg, MAP 123 mmHg, SPO^2 90%, and respiratory frequency 32x/min. The patient appeared agitated, pale, and breathless and had difficulty expressing complaints when first assessed. The surgical wound looked clean with an active drain.

Table 1. Observation result

Component	DAY 1		DAY 2	
	Before	After	Before	After
GCS	Delirium	Delirium	Delirium	Deliriu m
EMV	E4V4M5	E4V4M5	E4V4M6	E4V4M6
Blood Pressure	166/102	159/96	156/96	142/96
MAP	123	114	116	111
HR	128	126	111	109
SPO^2	90	92	93	95
RR	32	28	28	28
Suhu	36.3	36.5	36.5	36.5

Table 2. Observasion Result

Component	DAY 3		DAY 4	
	Before	After	Before	After
GCS	Deliriu m	Deliriu m	CM	CM
EMV	E4V4M6	E4V4M6	E4V5M6	E4V5M6
Blood Pressure	140/100	139/95	136/96	125/80
MAP	113	109	109	93
HR	111	102	96	96
SPO^2	91	95	95	97
RR	25	24	24	24
Suhu	36.6	36.6	36.6	36.6

The application of the 30-degree head elevation position intervention in patients with Space Occupying Lesion (SOL) after craniotomy in the ICU room of RSUD Umar Wirahadikusumah showed positive results in improving cerebral tissue perfusion and reducing clinical symptoms experienced by patients. The application of a 30- degree head position in post-craniotomy Space Occupying Lesion (SOL) patients has a significant impact on improving cerebral tissue perfusion, which can be seen from various improved clinical parameters, during the 4-day intervention. There was a decrease in subjective symptoms such as dizziness, pain, tightness, and hallucinations, as well as stabilization of vital signs indicating that 30-degree head elevation can be an effective nonpharmacological intervention in managing cerebral perfusion disorders (Tsigaras et al., 2023).

The application of a 30-degree head elevation position in patients has been shown to have a positive impact on improving brain tissue perfusion while reducing clinical symptoms associated with increased ICP (Dobson et al., 2024).The results obtained by the researchers showed that during the
4 days of intervention, the patient's condition experienced significant improvements
both objectively (GCS, blood pressure, MAP, pulse, respiratory frequency, oxygen saturation, and body temperature) and subjectively (dizziness, pain, tightness, and hallucinations). The results showed that during the four days of intervention, the patient's condition improved significantly, both objectively (GCS, blood pressure,
body temperature, pulse) and subjectively (pain, nausea, vomiting, and dizziness) (Jaradat et al., 2025) Based on the evaluation results during the 4 days of intervention, there was a gradual increase in the patient's level of consciousness, as indicated by an increase in GCS score from 9 to 15. 30-degree head elevation position can increase cerebral perfusion in patients with low levels of consciousness (delirium) this is in line with research conducted by Ginting et al (2020) which states that there is an effect of head elevation in increasing the level of consciousness (GCS). Researchers also found that physiological parameters such as blood pressure, pulse, MAP, respiratory rate, and oxygen saturation showed significant improvement. Blood pressure from 166/102 mmHg on the last day of intervention to 125/80 mmHg, pulse rate from 128x/min dropped to 96x/min, and MAP from 123 mmHg to 93 mmHg which is a significant change in mean arterial pressure, respiratory rate from 32x/min to 24x/min, Oxygen saturation from 90% to 97% The results showed that intervention with a 30-degree head elevation position had a positive impact on changes in patient physiological parameters, such as blood pressure, heart rate, respiration rate, and oxygen saturation (SpO^2).

These results show significant changes, this is in line with research conducted by Pertami et al (2017) which states that the head elevation position performed for 2 hours has a significant effect on improving blood pressure and mean arterial pressure (MAP). These results are also in

line with the findings of Ginanjar et al (2025) who stated that 30-degree head elevation had improvements in blood pressure, heart rate and MAP so that 30° head elevation was proven effective in improving cerebral perfusion. These results are also in line with research conducted by Szczygielski et al (2023) which states that maintaining the elevation head position for a longer period, for 2 hours contributes to a decrease in brain edema, improved perfusion, and faster neurological recovery, compared to only being done in a short time. The physiological mechanism underlying these findings is the improvement of more stable venous return and reduction of vascular compression over a longer period. The results of this study are also in line with Azizah & Arofiati (2023) who stated that there was a significant increase in oxygen saturation after being given a 30-degree head elevation position. However, research conducted by Syaharuddin et al (2025) states that head elevation of 30 degrees performed for 30 minutes does not significantly affect changes in blood pressure. This difference indicates that the duration of the intervention plays an important role, where maintaining the head position for a sufficient period is the main key to obtaining optimal results.

This head elevation position also affects other nursing diagnoses such as acute pain, it was found that the patient's pain level from a scale of 5 to a scale of 0 is supported by research by Handayani et al (2024) Providing pharmacological therapy interventions and non-pharmacological therapy, namely 30-degree head elevation, the results of a decrease in the pain scale from the beginning of the assessment, namely a pain scale of 6 decreased to no pain or a pain scale of 0 NRS (0-10).

Head elevation of 30 degrees provides favorable physiological and neurohumoral effects, mainly related to increased blood flow to the brain, decreased intracranial pressure, and improved cerebral tissue oxygenation. The main mechanism involves changes in hemodynamics, such as increased venous return and decreased vascular resistance, which then impact the neurohumoral system through the regulation of blood pressure and respiration (Yunus & Damansyah, 2021). A head elevation of 30 degrees helps facilitate blood flow to the brain, especially in the cerebral region. This position reduces venous pressure in the head and neck so that the return of blood to the heart (venous return) becomes more optimal. Head elevation can affect the autonomic nervous system, which plays a role in regulating blood pressure, The neurohumoral system also plays a role in regulating the rhythm and depth of breathing, which can be affected by the position of head elevation. Head elevation position can affect brain activity, including the respiratory center and blood pressure regulation. This is because a head elevation position of 30 degrees can reduce the backflow of blood to the heart (preload), which can reduce pressure on the heart, and increase lung perfusion by helping better blood distribution to the upper body and lungs (Ginanjar et al, 2025). The application of the 30-degree head elevation position to patients in hospitals, particularly in intensive care units or neurology suites, is not a simple act of body positioning. This intervention requires specialized clinical competence from health workers based on a comprehensive understanding of cerebral physiology and advanced clinical assessment skills. (PPNI, 2021) explicitly states that therapeutic positioning interventions in neurocritical patients require specialized training, 30-degree head elevation does appear to be a simple action. However, as taught in the PPNI workshop on patient safety, in neurocritical nursing, there is no such thing as a "routine action". Every intervention, no matter how small, requires knowledge, skills, and attitudes that are by established competency standards.

According to the American Association of Neuroscience Nurses (2021) the 30-degree head elevation position is one of the essential components in the management of patients with acute neurological disorders. However, its application requires specialized knowledge of: (1) anatomy and physiology of cerebral blood flow, (2) mechanisms of intracranial pressure regulation, and
(3) the systemic hemodynamic impact of changes in body position. Nurses or health workers who will apply this position should have competence in:

1. Comprehensive neurological assessment including GCS monitoring and pupillary reaction
2. Interpretation of hemodynamic parameters (blood pressure, MAP, cardiac frequency)
3. Understanding of the correlation between body position and intracranial pressure
4. Ability to recognize early signs of neurological deterioration

The Brain Trauma Foundation (2017) emphasizes that these positional interventions should be performed by healthcare professionals who have received specialized training in the management of neuro-critical patients. This includes the ability to:

1. Evaluate the appropriateness of indications and contraindications.
2. Closely monitor the patient's physiological response

3. Make adjustments based on current clinical conditions

This is important because the decision to change the patient's head position must take into account various complex factors such as fluid volume status, hemodynamic stability, and airway conditions. "The application of head elevation positioning in neurological patients is a seemingly simple but complex intervention, requiring careful clinical assessment and ongoing monitoring," the latest clinical guidelines emphasize (American Association of Neuroscience Nurses, 2021). Therefore, health institutions must ensure that only competent health workers who have received adequate training are allowed to perform this positional intervention, especially in patients with unstable neurological conditions.

In implementing the 30-degree head elevation position intervention in patients with a diagnosis of SOL after craniotomy, several factors support and hinder successful implementation in intensive care and inpatient settings. The most significant supporting factor was the full support of the nursing team and medical personnel in the ICU. In addition, the patient's cooperativeness, despite initially experiencing mild delirium, also facilitated the process of therapeutic communication and the implementation of ongoing interventions. The ICU's complete facilities, including a bed with automatic angle adjustment and a head elevation gauge, allowed the intervention to be carried out accurately and consistently.

However, this intervention also faces several obstacles, especially when the patient has been transferred from the ICU to a regular inpatient room. The unavailability of an automatic head angle measuring device in the inpatient room requires nurses to position the head manually, using visual guidance or simple tools such as an angle ruler. This risk causing inconsistency in head elevation which may affect the effectiveness of the intervention. In an article by Mulkey et al (2014) it is mentioned that one of the challenges of implementing positioning in the care of neurological patients is the lack of precision measuring instruments in regular treatment rooms, which requires training and adaptive approaches for nurses.

The main limitation of this study is that direct measurement of intracranial pressure (ICP) was not carried out because the indications for ICP monitoring are selective, such as severe brain trauma with GCS $\leq$ 8, massive intracranial hemorrhage, diffuse brain edema, risk of brain herniation, and from the results of interviews with ICU nurses at RSUD Umar Wirahadikusumah stated that ICP measurements were only carried out by Doctor Sp.S. Invasive ICP measurements require special devices such as intraventricular catheters or intraparenchymal sensors, which are not available in the general ICU setting. Therefore, the parameters used are indirect indicators.

Sunil Munakomi, 2024) mentioned that although ICP monitoring indicators are quite representative, direct measurement will provide more precise data. Invasive intracranial pressure (ICP) measurement is the gold standard in assessing cerebral perfusion, especially in patients with traumatic brain injury (TBI), stroke, or other critical neurological disorders. However, ICP monitoring requires invasive procedures such as intraparenchymal monitor insertion or ventriculostomy, which are at risk of infection, bleeding, and other complications. Therefore, in situations where invasive monitoring is not available or not possible, some non-invasive clinical parameters can be used as indirect indicators of cerebral perfusion, including:

1. Glasgow Coma Scale (GCS): Assesses the patient's level of consciousness and may provide an early indication of neurological status.
2. Blood Pressure and Mean Arterial Pressure (MAP): MAP is used in the calculation of cerebral perfusion pressure (CPP), which is an important indicator in assessing brain perfusion.
3. Pulse Frequency and Respiratory Rate (RR): Changes in these parameters may indicate changes in the patient's hemodynamic and neurological status.
4. Oxygen Saturation (SpO_2): Provides information on blood oxygenation, which is important to ensure adequate brain perfusion (Winarno & Harahap, 2015).

CONCLUSION

This study aims to determine the effect of 30 30-degree head elevation position on improving cerebral tissue perfusion in patients with a diagnosis of space occupying lesion (SOL) after craniotomy, through a standardized nursing care approach and evidence-based practice. Based on the results of the nursing assessment, it was found that the main problem experienced by the patient was complaints of dizziness, which was an early indication of cerebral perfusion disorders. From the results of data analysis, several main nursing diagnoses were established, including risk of ineffective cerebral perfusion, acute pain, ineffective breathing patterns, and risk of infection. Nursing interventions provided refer to the Indonesian Nursing Outcome Standards (SLKI) and Indonesian Nursing Intervention Standards (SIKI). The main focus of the intervention was the 30-degree head elevationposition, which was carried out

consistently for 4 consecutive days with a duration of 2 hours each day, in addition to additional therapies such as pain management, oxygen therapy, aseptic technique, and patient and family education. The nursing evaluation showed a significant improvement in cerebral perfusion, as evidenced by the improvement of the patient's neurological condition: consciousness status improved from delirium to compos mentis, and Mean Arterial Pressure (MAP) value decreased from 123 mmHg to 93 mmHg, indicating better hemodynamic stabilization.

Thus, the 30-degree head elevation position intervention is effective and proven to be consistent with theory and evidence-based practice in improving cerebral perfusion in post-craniotomy SOL patients. Despite limitations, the results of this study make an important contribution to critical nursing practice and can be the basis for the development of more effective ICU nursing protocols.

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