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Analysis of Physiological Factors that Affect MAP (Mean Arterial Pressure) in Post Trepanation Patiens in Intensive Care Instalations

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ABSTRACT

MAP (Mean Arterial Pressure) is the average arterial pressure required for blood circulation to the brain. In trepanation post op patients, MAP is an indicator of postoperative prognosis. This MAP is influenced by several physiological factors, namely heart rate, hematocrit and age. This study aims to determine and explain the effect of these three factors on MAP (Mean Arterial Pressure) in post-op trepanation patients at the Intensive Care Installation of Mardi Waluyo General Hospital, Blitar City. The design of this study is Cross-Sectional. Source of data used is secondary data. Data collection is done by observation method. The research sample was all medical records of trepanation post-op patients at the Intensive Care Installation of Mardi Waluyo Hospital, Blitar City who were treated from January to December 2022 who met the inclusion criteria, totaling 42 respondents. Data analysis using binary regression with a significance degree of p value less than 0,05 ($p<0.05$). The results showed that the Nagelkerke R Square (Model Summary) value was 0.314. This shows that the contribution or influence of physiological factors (heart rate, hematocrit, age) on MAP is 31.4%, while the remaining 68.6% is determined by other variables that are not taken into account in this research model. It is suggested to health service providers, especially nurses, to further improve their ability to analyze critical values of patients to prevent worsening of the prognosis.

Keywords: Physiological Factors, MAP, Post Op Trepanation

Background

Meanwhile, stimulation from pain due to incision, endotracheal intubation, bladder distension, pre-surgical discontinuation of antihypertensive drugs, can cause hypertension (1). From previous research at Mardi Waluyo Hospital, Blitar City, in 2019 the most data was found in brain injury patients, MAP values > 150 mmHg were 59.5% which resulted in death. Recearch result said that the MAP value influences patient mortality rates related to brain perfusion (2). This statement is proven by the highest mortality data occurring in patients with MAP values < 50 mmHg as many as 17.6% with 100% of patients dying (9 people) and patients with MAP values > 150 mmHg as many as 13 people with 77% of patients dying (10 person).

Various factors can influence the MAP value. The size of the bleeding area is also related to the amount of bleeding that occurs. Apart from that, there are other factors that can influence the MAP value, including physiological factors, which consist of cardiac output, peripheral resistance, blood volume, blood viscosity, and blood vessel elasticity. Of these factors, there are some that can be measured directly, namely cardiac output with heart rate parameters, blood viscosity with hematocrit level parameters, and blood vessel elasticity which is associated with age (3).

According to the Ministry of Health, the intensive room or ICU has standard entry criteria consisting of priority 1, priority 2, and priority 3. Post-op patients trepanation is included in priority 1, namely critically ill, unstable patients who require intensive and titrated therapy, such as: ventilation support or assistance, devices to support the function of other organs or systems, infusions, vasoactive or inotropic drugs, anti-arrhythmic drugs, and other treatments continuously. In the IPI (Intensive Care Installation) room at Mardi Waluyo Hospital, Blitar City, monitor vital signs (tension, pulse, respiration rate, oxygen saturation and MAP) to determine the hemodynamic status of post-trepanation patients using the available NIBP (Non-Invasive Blood Pressure) monitor. in each patient bed. This NIBP monitor is connected to the central monitor in the Nurse Station, so that nurses can access the patient's vital signs at any time.

From a preliminary study conducted by researchers, it was found that 58 post-trepanation patients were treated at the IPI (Intensive Care Installation) of Mardi Waluyo Regional Hospital, Blitar City in 2021, consisting of adult patients and children with a post-trepanation death rate of 16 cases or 27. 6%, with details of 15 cases due to brain hemorrhage and 1 case due to brain tumor (Meningioma). Meanwhile, in 2022 there will be 70 post-trepanation patients treated at the IPI (Intensive Care Installation) with 20 deaths or 28.6% caused by brain hemorrhage (IPI Room Census Book, Mardi Waluyo Hospital, Blitar City, 2021-2022). From these data it can be seen that there has been an increase in cases of death in post-op trepanation patients treated in the Seruni IPI (Intensive Care Installation) room at Mardi Waluyo Regional Hospital, Blitar City.

Based on the background above, researchers are interested in analyzing the physiological factors that influence MAP (Mean Arterial Pressure) in post-trepanation patients in Intensive Care Installations.

Methods

The design of this study is Cross-Sectional. Source of data used is secondary data. Data collection is done by observation method. The research sample was all medical records of trepanation post-op patients at the Intensive Care Installation of Mardi Waluyo Hospital, Blitar City who were treated from January to December 2022 who met the inclusion criteria, totaling 42 respondents

Results

This research was carried out on 14-15 June 2023 in the Medical Records Room of Mardi Waluyo Regional Hospital, Blitar City. This study uses secondary data, namely medical records of patients treated at the Seruni Intensive Care Installation (IPI) from January to December 2022. The total population is 70 patients, and Those who met the inclusion criteria to be used as research samples were 42 respondents. The results of this research are as follows:

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General data

Table 1 Characteristics of Research Respondents Analysis of Physiological Factors That Influence MAP (Mean Arterial Pressure) in Post Trepanation Patients in Intensive Care Installations

Characteristics Respondent	Frequency	Percentage (%)
Gender		
Male	20	48
Female	22	52
Medical Diagnosis		
Brain hemorrhage:	12	29
Not elderly: Trauma	1	2
Elderly: Trauma	3	7
Non-traumatic (CVA)	18	43
Brain tumor :	1	2
Not Elderly	7	17
Oxygenation Support:		
No Ventilator	12	29
With Ventilator	30	71
Total Oxygen Saturation		
< 90%	2	4
>90%	40	96
Therapy Received		
Infusion fluids (RL, NS)	42	100
Analgesic	40	95
Medications that can affect blood pressure (Vascon, Nicardipine, Mannitol)	22	52

Based on table 4.1, it is known that the gender distribution of respondents is mostly female, namely 22 respondents (52%). The most common medical diagnosis was CVA bleeding which occurred in the elderly (>45 years), namely 18 respondents (43%). Most oxygenation support uses a ventilator, 30 respondents (71%). The highest oxygen saturation was > 90%, namely 40 respondents (96%). For the therapy obtained: IV fluids were 42 respondents (100%), analgesics were given to 40 respondents (95%), and drugs that could affect blood pressure were 22 respondents (52%).

Focus data

Table 2 Heart Rate, Hematokrit, Age, and MAP Frequency Distribution of Respondents Post Trepanation in Intensive Care Installations

Characteristics Respondent	Frequency	Percentage (%)
Heart rate		
Normal	26	61,9
Upnormal	16	38,1
Hematokrit		
Normal	15	35,7
Upnormal	27	64,3

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Age		
Not elderly	15	35,7
Elderly	27	64,3
MAP		
Normal	41	97,6
Upnormal	1	2,4

Based on table 2, it can be seen that the heart rate variable which has the highest percentage is heart rate with a normal value of 26 respondents (61.9%). hematocrit variable which has the highest percentage is hematocrit with an abnormal value of 27 respondents (64.3%). Age variable which has the largest percentage is the elderly, 27 respondents (64.3%). MAP variable which has the highest percentage is MAP with a normal value of 41 respondents (97.6%). Based on the Binary Regression Analysis results in this research, the Nagelkerke R Square (Model Summary) value was 0.314. This shows that the contribution or influence of the independent variables (heart rate, hematocrit, age) on the dependent variable (MAP) is 31.4%, while the remaining 68.6% is determined by other variables that are not taken into account in this research model.

Discussion

The heart rate has a normal range of 60-90 beats/minute. A heart rate of less than 60 beats/minute (< 60 beats/minute) is called bradycardia and more than 90 beats/minute (> 90 beats/minute) is called tachycardia . The heart rate in post-op trepanation patients can be influenced by several things. One of the main ones is acute post-surgical pain disorders . This is in line with the research that the nursing problem that is the main concern for post-craniotomy patients is acute pain. Pain worsens in the first few days after surgery. The intensity of pain experienced by post-trepanation patients peaks on the day of surgery and the 4th post-operative (4). Almost all post-trepanation patients use ventilators, the use of ventilators has a risk of ventilator-associated events (5)

Based on table 2, it can be seen that the age variable which has the largest percentage is elderly age. The frequency of elderly respondents was 27 respondents (64.3%). WHO classifies the elderly as: middle age (45-59 years), elderly (60-74 years), old (75-90 years), and very old. (over 90 years) (6). In general, age factors can influence a person's blood pressure. As you get older, your blood pressure will increase. This is because at the age of more than 50 years the flexibility (elasticity) of large arteries decreases, so that blood flow is forced through narrow blood vessels. This is what causes blood pressure in the elderly to tend to increase (7).

Narrowing of blood vessels is caused by thickening of the tunica intima of the arterial walls, accumulation of collagen and AGEs in the connective tissue of blood vessels, causing a decrease in the elasticity of blood vessels and in the tunica media the arterial walls become stiff and fibrotic, making it easier for atherosclerosis to occur (8). The facts obtained in this research, the medical diagnosis It often occurs in the age range >45 years and above due to CVA bleeding, namely 19 respondents. The incidence of CVA bleeding is closely related to a sudden increase in blood pressure, causing blood vessels in the brain to burst (9). This tendency to increase blood pressure in the elderly can be caused by changes in physiology and degenerative diseases that often appear in this age range. One of them is atherosclerosis. Meanwhile, for the age range of less than 50 years, the cause of trepanation was found to be a medical diagnosis due to brain hemorrhage due to trauma and the presence of a mass (brain tumor) (10).

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The MAP variable that has the highest percentage is MAP with a normal value. The frequency of respondents with normal MAP was 41 respondents (97.6%). MAP (Mean Arterial Pressure) reflects the average pressure in the arteries throughout the cardiac cycle. Normal values are between 50-150 mmHg. If the MAP flow is < 50 mmHg, it can cause cerebral ischemia, whereas if the MAP is > 150 mmHg, damage to the blood-brain barrier can occur. In the management of post-op trepanation patients, maintaining MAP values within the normal range is one of the priority actions. This is done to minimize the risk of rebleeding, especially in elderly patients (11). When the brain is injured, the ability to control the body's organ systems is disrupted. One of them is controlling blood pressure

Due to changes in ICP which tend to increase or decrease in blood pressure due to worsening of the condition. To overcome this, treatment management is carried out starting from medical therapy and nursing care (12).

The facts of this research show that as many as 22 respondents (52% of respondents) received therapy to maintain MAP in the normal range. Giving blood pressure-lowering drugs such as Nicardipine, Herbesser, HCT, Amlodipine is expected to reduce systolic and diastolic blood pressure which ultimately improves the MAP value to within the normal range. Giving mannitol fluid to reduce brain edema can also reduce MAP. In addition, providing nursing care in the form of gradual and continuous positioning can reduce ICP thereby improving brain perfusion (13). Thus, blood pressure can reach normal values .

Meanwhile, when conditions decline due to a poor prognosis, the body is unable to compensate for the changes that occur, so external supportive measures are needed. A decrease in blood pressure is an indication that the haemodynamic mechanism is being disturbed. Giving inotropic therapy such as Norephineprin is an option to maintain blood pressure within the normal range (14). Apart from that, good and adequate oxygenation support also has a positive impact on the stability of the hemodynamic system (15). One of the oxygenation supports in question is the use of a ventilator. From the research data, it was found that 30 respondents (71%) used ventilator support. With ventilator support, the saturation value of most respondents was high is above 90% so this also supports the body's system to maintain MAP within the normal range.

Identify the relationship between heart rate, hematocrit and age with MAP in post-trepanation patients in intensive care installations. Based on the SPSS output results in this research, the Nagelkerke R Square (Model Summary) value was 0.314. This shows that the contribution or influence of the independent variables (heart rate, hematocrit, age) on the dependent variable (MAP) is 31.4%, while the remaining 68.6% is determined by other variables that are not taken into account in this research model. MAP (Mean Arterial Pressure) is one of the prognostic indicators of a patient's condition. Abnormal changes in MAP indicate impaired cerebral perfusion and intracranial pressure (16). If this abnormal value continues, it can worsen the patient's condition.

In this study, it was found that most of the respondents' MAP values were normal. This normal range is influenced by physiological factors of the respondent by 31.4%. The physiological factors in question are heart rate, hematocrit and age. These three physiological factors are part of the five factors that influence MAP. In this study, the three physiological factors studied had an influence of 31.4%. This is caused by the presence of other physiological factors that are not taken into account and also external factors that have an influence, namely 68.6%.

Physiological factors that were not taken into account in this study were peripheral resistance and blood volume. There is influence from external factors such as using a

ventilator, administering pressure-supporting drugs blood, nursing care management, pre-op GCS, extent of brain hemorrhage that occurs can be other factors that can influence the MAP value in post-trepanation patients.

This research is which states that the effects of post-trepanation/craniotomy pain have an impact on cardiovascular outcomes including increasing heart rate and blood pressure (17). This research is in line stated that increasing blood pressure has a significant positive relationship between hemoglobin levels, hematocrit values and the number of erythrocytes in hypertension sufferers which can be the main cause of brain hemorrhage (18). Apart from that, the statement that supports states that older age tends to have a high risk of death with the MAP value as an indicator in intracerebral hemorrhage patients (19).

Conclusion and Recommendations

Heart rate factors in post-trepanation patients who had normal values were 26 respondents (61.9%) while 16 respondents (38.1%) were abnormal. The hematocrit factor that had a normal value was 15 respondents (35.7%), while 27 respondents (64.3%) had an abnormal value. Meanwhile, for the age factor, there were 15 respondents (35.7%) who were less than 45 years old (not elderly) and 27 respondents (64.3%) who were more than 45 years old (elderly). .MAP (Mean Arterial Pressure) in post-trepanation patients showed normal values as many as 41 respondents (97.6%), while abnormal values were 1 respondent (2.4%). There is a relationship or influence between physiological factors (heart rate, hematocrit, age) and MAP (Mean Arterial Pressure) in post-trepanation patients, namely 31.4%. Meanwhile, 68.6% was influenced by other factors not taken into account in this study.

This research can be developed by examining 68.6% of the other factors in this study, namely peripheral resistance and blood volume and the possibility of external (non-physiological) factors that can influence MAP. The uniformity of medical diagnosis needs to be taken into account before starting. research activities and the use of other research methods in order to add to scientific studies in the field of nursing.

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