A predictor of outcome following head injury: A retrospective study

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Abstract

Background: Head injuries are a major cause of death and disability because of trauma, it happed in many countries of the world. The case of head injuries in the Emergency department, need immediate managing to victim to prevent further complications. The Nurses required to assess and recognize abnormality as soon as possible and further management of the victim to save their life. Through the physiological status. The patient's physiological status is the best way to recognize the prognosis, such as GCS, systolic blood pressure, respiratory rate, body temperature, and blood glucose levels while admitted to emergency ward.

Purpose: To analyze and determine (simultaneously) a predicting factor the most dominant influencing significantly of outcome following head injury

Methods: A retrospective approach by analyze patient's medical records on January-December period in 2018 at H. Adam Malik General Hospital Medan. The study sample comprised 166 medical records which taken by purposive sampling technique with the following criteria: new admission (not referral), there were available data such GCS data, systolic blood pressure, respiratory rate, body temperature, blood glucose levels within 7 days under treatment.

Results: Logistic regression test found that GSC (p 0.000; OR 2.583), systolic blood pressure (p 0.024; OR 0.947), and blood sugar levels (0.038; OR 0.982) had a significant effect on the mortality. The nurse must pay attention in handling patient head injuries who have a lower GCS scores and systolic blood pressure, following by high blood sugar levels.

Conclusion: By evaluation of GCS, systolic blood pressure and blood sugar levels can predict the patient's current condition. The lower the GCS score, the higher the risk of death by 2.583 times and the lower the systolic blood pressure, the greater the risk of mortality by 0.947 times. The higher the blood sugar level, the risk of death increased by 0.982 times.

Keywords: A predictor; Outcome; Head injury; A retrospective study.

INTRODUCTION

Head injury is a major cause of mortality and morbidity because of trauma, which also causes economic and social problems (Areas et al., 2019; Strnad et al., 2017) whose incidence has increased from 0.4% (Ministry of Health Republic of Indonesia Indonesia, 2013) to 11.9% (Ministry of Health of the Republic of Indonesia, 2018). Because of head injuries, over 100 thousand victim died and 700 thousand more needed intensive care which cost around 60.43 million US dollars each year (Aprilia, 2017; Putra et al., 2016). Prompt management can prevent head injury patients from mortality and morbidity (Suwaryo et al., 2016). A nurse has an important role in the management of head injury patients (Varghese et al., 2017). The nurse must assess every response and abnormal reactions, recognize current patient's condition and patient's prognosis, nurses can review their physiological status and saving patient life (Suwaryo et al., 2016).

Physiological status assessed from level of consciousness (GCS), systolic blood pressure and respiratory rate (Aprilia, 2017). Apart from these three things, other physiological statuses such as body temperature and blood glucose levels (Damanik & Sipayung, 2019; Dewi et al., 2017). Observation of physiological status, body temperature and blood glucose levels can help nurses sort out patients who have survival rates high and predict the risk of mortality, following by optimize treatment (Mendonsa, 2019). Therefore, a head injury prediction method with an accurate initial assessment needed, it is an advantage to help predict the patient's current condition.

RESEARCH METHODS

The design of an observational analytic study with a retrospective approach was to analyse the patient's medical records at H. Adam Malik Medan General Hospital. The study population was 433 patient's medical records by diagnosed head injury (previously admitted). Samples taken by using purposive sampling technique with the following criteria: newly admitted (no referral), GCS score data, systolic blood pressure, respiratory rate, body temperature, blood sugar levels. Based on these criteria, a sample got of 166 patient's medical record. Approved by the Health Research Ethics Committee of the Faculty of Medicine, Muhammadiyah University of North Sumatra, with letter number 393/KEPKFKUMSU/ 2020.

Data collection used the observation sheet as an instrument to identify GCS scores, systolic blood pressure values, respiratory rates and the patient's condition after receiving treatment for 7 days, whether the patient was alive or dead. GCS scores, systolic blood pressure values, respiratory rates, body temperature, and blood sugar levels were taken from the initial assessment data when first admission. The data analysis used was the Spearman correlation test to know the relationship of the independent variables (GCS, systolic blood pressure, frequency breath, body temperature, and blood sugar levels) and a logistic regression test (simultaneously). whether the independent variables significantly influence the outcome of head injury patients and to determine effect most predominantly factors.

RESEARCH RESULTS

Table 1. Patient Record Databases N = 166

Data Recording	M±SD (Range)	SE
GCS	11.74±3.23 (3-15)	0.25
Temperature (°C)	36.58±0.99 (31.7-38.0)	0.77
Respiratory rate (times/menit)	23.93±3.92 (9-35)	0.30
Systolic blood pressure (mmHg)	131.87±22.08 (58-193)	1.71
Blood Sugar Levels (mg/dL)	151.26±100.857 (74-569)	7.828
Patient condition when discharge	n (%)	
Died	44 (26.5)	
Recovery	118 (71.0)	
Referral to other Hospital	4 (2.5)	

Based on table 1. Knowing that the average GCS is 11.74 (SD = 3.23) with the lowest GCS is 3 and the highest GCS is 15. The average body temperature is 36.58 (SD = 0.99) with the lowest temperature being 31.7°C and the highest temperature being 38°C. The average frequency of breaths was 23.93 times / minute (SD = 3.92) with the lowest breathing frequency being 9 times / minute and the highest breathing frequency being 35 times/minute. The mean systolic blood pressure was 131.87 mmHg (SD = 22.08) with a systolic blood pressure low was 58 mmHg and the highest systolic blood pressure was 193 mmHg. The average blood sugar level was 151.26 mg (SD = 100.857) with the lowest blood sugar level was 74 mg and the highest blood sugar level was 569 mg. Most of the patients when discharge from hospital were a recovery of 118 (71.0%).

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Table 2. Results of the Spearman Correlation Test

Variable	Sig.
GCS	.000
Temperature	.354
Respiratory rate	.000
Systolic blood pressure	.000
Blood Sugar Levels	.000

Based on table 2. Knowing that only three result such as GCS, respiratory rate, systolic blood pressure, and blood sugar levels have a relationship with patients with head injury.

Table 3. Logistic Regression Analysis

Variable	B	S.E.	Sig.	Exp(B)
GCS	-.949	.254	.000	2.583
Respiratory rate	.005	.123	.967	1.005
Systolic blood pressure	-.055	.024	.024	.947
Blood Sugar Levels	.019	.009	.038	.982

Table 3. Shows that the results of logistic regression identified that GCS, systolic blood pressure and blood sugar levels have significantly affected to patients with head injury, with GCS as the most dominant factor (B = 2.583). GCS and systolic blood pressure have a negative pattern (-.949; -.055), namely the higher the GCS value and systolic blood pressure, the lower the risk of mortality or the lower the GCS and blood pressure values, the higher the risk of mortality. Meanwhile, blood sugar levels have a positive pattern (0.019), namely the higher the blood sugar levels, the higher the risk of mortality among patient with head injury.

DISCUSSION

Assessment of the level of consciousness (GCS) in trauma patients is very important because it can predict the patient's prognosis (Osler et al., 2016). This study found that the lower the GCS value, the higher the risk of mortality. (Kasmaei et al., 2015) explained that score GCS <9 as an independent predictor of outcome in head injury patients. Research (Sumarno et al., 2016b) on 46 respondents in the Emergency Department

also found that the GCS score is a major predictor of mortality in head injury patients.

GCS associated with structural or brain tissue disorders that can cause brain tissue death. Brain tissue that has experienced death is important data that needs, because brain tissue has irreversible properties. The brain is the center for regulating the body's vital systems such as the system respiratory and the system cardiovascular so that if there is damage or interference to the brain, it will interfere with the function of these systems, which increases the risk of death (Sumarno et al., 2016). The low GCS score at the beginning of the patient entering the emergency ward shows that there is a serious brain disorder. The severity of the disturbance that occurs will disrupt the work of the brain, which increases the patient's death threat.

This study found that respiratory rate had no effect on the mortality rate of head injury patients. This differs from research (Bruijns et al., 2014) which found that systolic blood pressure and respiratory rate simultaneously are good predictors for determining among patient with head injury. The breathing rate of less than 10 times per minute associated with a poor prognosis because of decreased perfusion and oxygenation to the brain

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or shows a secondary effect of increased intracranial pressure in the form of cerebral compression, especially in the early phase of head injury. The prognosis of head injury influenced by the oxygenation status at the time admission in to emergency ward (Ankita et al., 2015).

Apart from GCS, systolic blood pressure also has an influence, that systolic blood pressure <90 mmHg has a relationship with mortality (Imen et al., 2015). Another study found that the dominant factor is systolic blood pressure. Blood pressure is one of the important data to predict the prognosis. Patients with hypotension will have a higher risk of dying, it related to impaired blood flow to the brain (Sumarno et al., 2016; Suwaryo et al., 2016). When blood pressure below 90 mmHg associated with higher mortality or would like be longer hospitalization (Imen et al., 2015; Ristanto et al., 2016). Decreased systolic blood pressure (<90 mmHg), if it occurs continuously results in a decrease in cerebral perfusion pressure (CPP). lower cerebral perfusion pressure cause ischemia and infarction in brain tissue. Therefore, blood pressure must maintain within the normal range, so that CPP is also in the normal range and prevented tissue ischemia cerebral.

The results also showed that blood sugar levels had an influence on the outcome of head injury patients. Research by Kafaki et al (2016) on 220 respondents in Iran found that high blood sugar levels on admission to hospital associated with an increase in mortality. Hyperglycemia after head injury is common and associated with poor clinical result and increased mortality (Shi et al., 2016).

In the acute phase, the body will adapt to stress and this will stimulate increased secretion of hormones (growth, catecholamines) and stimulation of the CRH system. This hormone stimulation will cause an increase in blood glucose levels. Increased blood glucose levels lead to increased blood viscosity and scattering of disruption of small vessels, resulting in ischemia and hypoxia in the brain tissue. Hyperglycemia also has the potential to speed up brain vasospasm. This can worsen neurological deficits and make worse prognosis (Shi et al., 2016).

Head injuries have a high mortality rate. For this reason, an initial assessment of GCS, systolic blood pressure, and blood glucose levels is essential. By observing GCS, systolic blood pressure, and blood glucose levels from the beginning of the patient's admission, nurses manage patients who have a high survival rates, optimize treatment and predict the risk of mortality.

CONCLUSION

GCS, systolic blood pressure and blood sugar levels can predict the outcome of a patient with head injury. The lower the GCS score, the higher the risk of death by 2.583 times and the lower the systolic blood pressure, the greater the risk of mortality by 0.947 times. The higher the blood sugar level, the risk of death increased by 0.982 times.

SUGGESTION

The ability of nurses to handle patients faster fight with the time and immediately to provide basic trauma life support will help save life patients. Examining the patient's level of consciousness is a very important first step and basic life support, and oxygenation that should give from beginning.

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