

BODY TEMPERATURE AS A NEW PREDICTOR OF MORTALITY IN HEAD TRAUMA PATIENTS

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ABSTRAK

Key Words :

Hyperthermia,
Hypothermia,
Normothermia,
Mortality ,

Abstract: Head trauma is a neurological emergency that has fairly complex impacts such as physical, cognitive, psychosocial functioning, temporary care. Sixty-five percent of patients with head trauma experience elevated body temperature. Any increase in body temperature by 1 °C can have a 5% effect on brain blood flow which lead patients to mortality. Nurses are responsible for patients who experience increased body temperature, especially in providing professional nursing care. The purpose of this research is to know the correlation of body with mortality of head trauma patient at RSUD Ulin Banjarmasin. This research uses non probability sampling method with consecutive sampling technique. The study was conducted in December 2017-January 2018 using an observation sheet. The data analysis shows the p value of 0,003 <0,05 which indicates that H0 is rejected means there is a correlation between the body and the mortality of the head trauma patient at Ulin Banjarmasin Hospital. The higher the patient's body temperature the more likely it is to be at risk of mortality.

Abstrak: Trauma kepala adalah suatu kedaruratan neorologis yang mempunyai dampak cukup kompleks seperti gangguan fisik, kognitif, fungsi psikososial, baik bersifat sementara ataupun permanen. Sebesar 68% pasien dengan trauma kepala mengalami peningkatan suhu tubuh. Setiap naiknya angka suhu tubuh sebesar 1°C dapat memberi dampak perubahan aliran darah otak sebesar 5% yang dapat mengarahkan pasien pada mortalitas. Perawat bertanggung jawab terhadap pasien yang mengalami peningkatan suhu tubuh, terutama dalam memberikan asuhan keperawatan profesional. Tujuan penelitian ini untuk mengetahui hubungan suhu tubuh dengan mortalitas pasien trauma kepala di RSUD Ulin Banjarmasin. Penelitian ini menggunakan metode non probability sampling dengan teknik consecutive sampling. Penelitian ini dilakukan sejak Desember 2017-Januari 2018 dengan menggunakan lembar observasi. Analisis data menunjukkan bahwa nilai p value sebesar 0,003 <0,05 yang menunjukkan bahwa H0 ditolak artinya ada hubungan suhu tubuh dengan mortalitas pasien trauma kepala di RSUD Ulin Banjarmasin. Semakin tinggi suhu tubuh pasien maka semakin berisiko terhadap mortalitas.

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INTRODUCTION

Head trauma is a neurological emergency with potential bad outcome in physical, cognitive, and psychosocial functions. Incidence of head trauma is still high, especially traffic accidents. Mortality due to head trauma is also increasing significantly.

Mortality due to traffic accidents has been increasing 83% in developing countries during 2000 – 2020, with head trauma as the highest kind of trauma (Salim, 2015). Approximately 2 million and more people had head trauma each year, which 75,000 of them had died and 100,000 of them survived with disability (Saadat, S, & Soori, 2011). At Ulin Banjarmasin General Hospital, there were 259 head trauma patients in 2015; 29 patients had died. This number had increased to 290 patients and 34 deaths in 2016. In 2017 (January – September), there was 217 head trauma patients and 6 deaths. In Ulin Banjarmasin General Hospital in January-September period, there were 968 head trauma patients with 61 deaths; 50 of them died in the first 24 hours.

It was stated before that 68% of head trauma patients had high body temperature (Thompson, 2003). This high temperature in head trauma patients could cause intracranial pressure increase with 78% mortality rate (Diringer et al, 2004)

High body temperature was a disruption in basic needs which commonly seen in patients. Nurse are responsible to identify patients with such condition and arrange a professional nursing care plans for patients' comfort and safety (Thompson, 2003).

METHOD

This was an analytical survey study with cohort design or prospective study with non-probability sampling method, i.e. consecutive sampling, with

42 samples. The study instrument was observation sheet used to record the early body temperature of head trauma patients presented to the Emergency Department of Ulin Banjarmasin General Hospital. Mortality was evaluated after 48 hours (Sugiono 2014).

RESULT AND DISCUSSION

Respondent Characteristics

1. Based on Gender

Table 1.

**Characteristics of Respondents
Base on Gender (n=42)**

Variable	f	%
Gender		
Male	26	62
Female	16	38
Total	42	100

Source: Primary data 2017-2018

There were 42 eligible subjects who had given consent to participate. As much as 26 subjects (62%) were males and 16 subjects (38%) were females. Males were considered more active and had riskier activities than females, therefore they were prone to head trauma. This finding was supported by data from Brain Injury Association of America (2013), which stated that male had 1.5 higher risk of head trauma than females (Brain Injury Association of America, 2013).

2. Based on Age

Table 2.

**Characteristics of respondents
based on age (n=42)**

Variable	F	%
Age 15-21	12	28,5
22-27	6	14
28-33	5	12
34-39	5	12
40-66	14	33
Total	42	100

Source: Primary data 2017-2018

Most of the head trauma patients were aged 40 – 66 years old (33,3%), followed by 15 – 21 years old (28,5%). Age was one of the factors related to head trauma event. Each age group (children, adolescents, and adults) had different activities, therefore there were different risk of head trauma in each group. Adolescents and adults were in productive period and their outdoor activities were prominent, causing them to have higher risk of head trauma due to traffic accident. Data from Centers of Disease Control (2011) supported this analysis, which stated that 75% of head trauma existed in age 15 and older (Azwar, 2011).

Among our subjects, 15 subjects had mild head trauma (35,7%), 13 subjects had moderate head trauma (31%), and 14 subjects had severe head trauma (33,3%). The dominance of mild head trauma was also found by Azwar et al, who stated that 64,4% of head trauma cases were mild, followed by 19,2% moderate trauma and 16,4% severe trauma.

Kinds of Head Trauma Base on Severity of Head Trauma Patients

3. Based on Kinds

Table 3.

Kinds of Head Trauma experienced of patients

Variable	f	%
Kinds of Head Trauma		
Mild		
Moderate	15	35,7
Severe	13	31
	14	33,3
Total	42	100

Source: Primary data 2017-2018

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trauma (33,3%). The dominance of mild head trauma was also found by Azwar et al, who stated that 64,4% of head trauma cases were mild, followed by 19,2% moderate trauma and 16,4% severe trauma.

Most of the trauma mechanism in our subjects were traffic accidents, which was 40 subjects (92,8%); the rest were caused by fall (7,1%). This finding was similar to a study by Nurfaise (2012), which stated that the most common mechanism for head trauma was traffic accident (87,2%). They found 46 cases of motorcycle vs. motorcycle accidents, 3 cases of motorcycle vs. bicycle accident, 9 cases of motorcycle vs. bicycle, 1 case of motorcycle vs. truck, 10 cases of motorcycles vs. pedestrians, and 1 case of falling from motorcycle. Trauma due to violence was only found in small percentage, i.e. 1%.

Body Temperature Distribution of Head Trauma Patients

4. Based on Body Temperature

Table 4.

Body temperature of head trauma patients

Variable	N	%
Body Temperature		
Hypothermia	0	0
Normothermia	34	81
Hyperthermia	8	16
Total	42	100

Source: Primary data 2017-2018

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motorcycle accidents, 3 cases of motorcycle vs. bicycle accident, 9 cases of motorcycle vs. bicycle, 1 case of motorcycle vs. truck, 10 cases of motorcycles vs. pedestrians, and 1 case of falling from motorcycle. Trauma due to violence was only found in small percentage, i.e. 1% (Nurfaise, 2011).

We did not find any patients with hypothermia; therefore, we divided the subjects into normothermia and hyperthermia group. Our mild and moderate head trauma patients did not have any history of hyperthermia. We found 8 severe head trauma patients (57,1%) who had hyperthermia; the rest of them were normothermia. The increase in body temperature was affected by the severity of head trauma, as found in post-traumatic cerebral inflammation, secondary infection, and hypothalamus destruction. Those pathologies were more commonly found in severe head trauma than in mild-moderate trauma.

It was proposed that the high body temperature in head trauma was due to cytokine release and related to bad outcome in acute phase after trauma. Cytokines were known to activate thermo-sensitive neuron in anterior hypothalamus to produce heat (Lunn, KW, Childs, 2010). This was similar to a study by Chatzipanteli et al, which found that hyperthermia after trauma was related to cytokine release and bad outcome (Allan et al, 2001). Hyperthermia in head trauma could also be caused by infection and inflammation (Chatzipanteli, 2000). Hyperthermia in the first 24 hours after trauma was related to acute phase response and IL-1 β synthesis in anterior hypothalamus.

Incidence of Mortality of Head Trauma Patients at Ulin Banjarmasin General Hospital

5. Based on Incidence Mortality

Table 5.

Incidence mortality of head trauma patient

Variable	f	%
Mortality		
Death	5	12
Life	37	88
Total	42	100

Source: Primary data 2017-2018

We found 5 subjects (12%) who died after head trauma. In a study by Saadat and Soori (2011), they stated that head trauma prevalence was more than 2 million patients per year with 75,000 deaths. A study by Djaja et al stated that traffic accidents and mortality rate in Indonesia was still high and did not show any significant improvement. This was different from our findings; which mortality was found in only 12% of head trauma patients. This could be due to our small sample that could not reflect the actual mortality rate. The severity of the head trauma, measured by GCS, could also affect the body temperature increase. Most of our subjects had severe head trauma, which was 14 subjects (33,3%). Among the 5 subjects who died due to head trauma, 4 of them (80%) was hyperthermia and severe head trauma and 1 of them (20%) was normothermia and mild head trauma.

Body temperature had to be regulated in all patients, but patients with head trauma need special attention. The high body temperature in these patients could increase brain metabolism, which eventually caused imbalance of ATP, which oxygen and glucose had important role in ATP synthesis. In ischemic phase, brain could only tolerate this imbalance in limited

time. One-degree body temperature shift could change blood flow to the brain as much as 5%, which causing the increase in intracranial pressure and eventually bad prognosis (Heindl, U, & Laub, 1996).

The Relationship of Body Temperature to Mortality of Head Trauma Patients at Ulin Banjarmasin General Hospital

6. Based on Analysis

Table 6. Analysis the relationship of body temperature to mortality of head trauma patients

Body Temperature	Mortality In 48 Hours			p value
	Life N (%)	Death N (%)	N (%)	
Normothermia	33 (78,57)	1 (2,38)	42 (100)	0,003
Hyperthermia	4 (9,52)	4 (9,52)		

Source: Primary data 2017-2018

Fisher exact test showed that p value of 0,003 (less than 0,05), which mean null hypothesis was denied. In other word, there was a significant relationship between body temperature and mortality in head trauma patients in Ulin Banjarmasin General Hospital. The higher the body temperature, the higher the mortality of head trauma patients.

This study results similar with a study by Thompson et al (2003) which stated the association between high body temperature in acute phase of head trauma with the bad neurological status (Thompson, 2003). Another study by Young et al showed that 80% of head trauma patients in critical phase who had body temperature $>38^{\circ}\text{C}$ in the three

days after trauma increased the mortality rate (Young et al, 2011).

CONCLUSION

Most of our study subjects in any degree of head trauma were normothermic. There were only 8 patients who had hyperthermia, who had severe head trauma. The lowest body temperature was 36°C and the highest body temperature was 39°C .

Mortality rate in our study was 5 out of 42 head trauma patients; among the 5 patients, 4 patients had hyperthermia and 1 patient had normothermia. The mean body temperature of died patients was $38,6^{\circ}\text{C}$. There was a relationship between body temperature and mortality in head trauma patients (p value 0,003). The higher the body temperature, the higher the mortality of head trauma patients.

SUGGESTION

We suggested the evaluation of mortality beyond the first 48 hours to complete the data.

REFERENCES

1. Azwar, Muhammad. (2011). *Gambaran cedera kepala dengan komplikasi perdarahan epidural di RSUD Dr. Soedarso Pontianak 1 Januari-31 Desember 2010*. Fakultas Kedokteran Universitas Tanjungpura Pontianak: Pontianak.
2. Allan, SM, Rothwell, NJ. (2001). *Cytokines and acute neurodegeneration. Nature Rev Neurosci*, 2(10) 734-744.
3. Brain Injury Association of America. (2013). *To the housecommittee on health. America: CDC*, hal. 1-3 .
4. Centers for Disease Control. (2011). Surveillance for traumatic brain injury. related deaths. *United States 1997-2007. MMWR*, 60(5), 1-30.

5. Chatzipanteli, K., Alonso, OF, Kraydieh, S, Dietrich, WD. (2000). *Importance of post traumatic hypothermia on the inflammatory response after fluid percussion brain injury: Biochemical and Immunocytochemical Studies. J. Cereb. Blood Flow Metab*, 3(20), 531-542.
6. Diringer, MN, Reaven, NL, Funk, SE, & Uman, GC. (2004). *Elevated body temperature independently contributes to increased length of stay in neurologic intensive care unit patients. Critical Care Medicine*, 32(7), 1489–1495.
7. Heindl, U, & Laub, M. (1996). *Outcome of persistent vegetative state following hypoxic or traumatic brain injury in children and adolescents, Neuropediatrics*, (27), 94–100.
8. Lunn, KW, Childs, C. (2010). *A systematic review of differences between brain temperature and core body temperature in adult patients with severe traumatic brain injury. Singapore National University Hospital (NUH) Centre for Evidence Based Nursing : A Collaborating Centre of The Joanna Briggs Institute.*
9. Nurfaise. (2011). *Hubungan derajat cedera kepala dan gambaran CT scan pada penderita cedera kepala di RSUD. Dr. Soedarso Program Periode Mei-Juli 2012. Skripsi Naskah Publikasi. Program Studi Pendidikan Dokter Fakultas Kedokteran, Universitas Tanjungpura, Pontianak: Pontianak.*
10. Saadat, S, & Soori, H. (2011). *Epidemiology of traffic injuries and motor vehicles utilization in the capital of Iran: a population based study. BMC Public Health*, 1(11), 488.
11. Salim C. (2015). Sistem penilaian trauma, *CDK-232*, 9(42), 7–9.
12. Sugiono. (2014). *Metode penelitian kuantitatif, kualitatif, dan kombinasi (Mixed Methods)*. Penerbit Alfabeta: Bandung.
13. Thompson, HJ, Tkacs, NC, Saatman, KE, Raghupathi, R, & McIntosh, TK. (2003). *Hyperthermia following traumatic brain injury: a critical evaluation. neurobiology of disease*, 3(13) 163–17.
14. Young, O., Saxena, M., Easwood, G.M., Bellomo, R., and Beasley, R. (2011). *Fever and fever management among intensive care patients with known or suspected infection : a multicentre prospective cohort study. Crit Care Resuse*, (13), 97-102.