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Neurocritical care for traumatic brain injury in intensive care unit of Dr H. Andi Abdurahman Noor Hospital, Indonesia



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ABSTRACT

Introduction: Traumatic brain injury (TBI) is an injury of head that disrupts the normal function of the brain. It can be caused by a bump, blow, or jolt to the head or a penetrating head injury. TBI is common and a major cause of morbidity and mortality worldwide. Neurocritical care is the intensive care provided to patients with severe neurosurgical conditions like TBI. It provides the interface between the brain and other organ systems.

Objective: This study aim to report the total incidence of TBI cases; to demonstrate the implementation of conservative therapy as neurocritical care of severe TBI patient who treated in ICU.

Method: This descriptive observational study was conducted in Intensive Care Unit DHAAN Hospital from 1st January until 31th December 2016. Total sampling was chosen in this study to observe the incident of TBI.

Result: The total of 372 cases of TBI was admitted to DHAAN Hospital from 1st January – 31th December 2016. Mild TBI was count 263 cases (69.8%), moderate TBI was 79 cases (18.5%), and severe TBI was count 47 cases (11.7%). All patients received conservative therapy without intracranial pressure monitoring. Most of the patients received ranitidine 50 mg-150mg/24 h to prevent the stress ulcer. Inotropic administration such as norepinephrine 0.1-0.5 µg/kg drip combined with dobutamine 10-20 µg/kg drip to maintain the mean arterial pressure between 50-65 mmHg.

Conclusion: Providing neurocritical care is important to reduce mortality or morbidity rate of TBI. The high mortality rate of seTBI in DHAAN Hospital is caused by lack of health facilities.

Keywords: Traumatic brain injury, Neurocritical care, Intensive care unit

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INTRODUCTION

Traumatic brain injury (TBI), defined as an injury of head that disrupts the normal function of the brain. This is a major problem in critical care medicine.^{1,2} World Health Organization (WHO) predicting that TBI and road traffic accidents will be the third greatest cause of disease and injury worldwide in 2020.^{2,3} In our aging population the number of elderly patients presenting with TBI has increased, and age appears to be an independent risk factor for TBI. Consequently, TBI presents a major health and socioeconomic problem.^{1,2,3}

Indonesia as one of developing country has many cases with TBI. In 2013, TBI was the leading of 100.000 cause of death in traffic accident. In South Borneo, there are 9.4 % cases of TBI in trauma cases especially in Tanah Bumbu regency one of the rural areas in South Borneo.^{3,4} The main causes of death associated with head injury are traffic accidents.⁵

TBI is a heterogeneous condition in terms of etiology, severity, and outcome. The most useful classification of severity is based on the level of consciousness assessed by Glasgow Coma Scale (GCS) after resuscitation.⁶ The GCS comprises the

sum score of the values from three components: eye, motor, and verbal scales.^{6,7} TBI is classified as mild (GCS 15–14), moderate (GCS 13–9), and severe (GCS 8–3).^{1,2,7}

TBI can be divided into primary and secondary brain injury. The primary injury occurs as the consequence of initial physical insult. The pattern and extent of damage will depend on the nature, intensity, and duration of the impact. Compression and shearing forces may result in skull fracture, contusions, intracranial hematoma, cerebral edema, and diffuse brain injury.⁸ Microscopically there is cell wall disruption and increased membrane permeability disrupting ionic homeostasis. The axonal tissue is particularly susceptible to injury. Head injury progresses over hours and days, resulting in a secondary injury. Inflammatory and neurotoxic processes result in vasogenic fluid accumulation within the brain, contributing to raised intracranial pressure (ICP), hypoperfusion, and cerebral ischemia.^{2,3,8}

In rural areas such as Tanah Bumbu Regency with low socioeconomic conditions has limitation in health workers and health facilities. In DHAAN Hospital, we found no neurosurgeon and CT

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scan to assess the TBI patient. This limitation also influences the TBI management. Most cases of TBI in DHAAN hospital can't be neurosurgical intervention because of distance referral hospital and the absence of money. Then TBI patients (especially seTBI) who refused referral are treated in intensive care unit (ICU) by the surgeon, neurologist, and intensivist. This study aims to report the total incidence of TBI cases determined by severity and age; to demonstrate the implementation of conservative therapy as neurocritical care of seTBI patient who treated in ICU.

METHODS

This descriptive observational study was conducted in Intensive Care Unit DHAAN Hospital from 1st January until 31th December 2016. Total sampling

was chosen in this study to observe the incident of TBI in Tanah Bumbu Regency. All of the subjects were patients who rejected to refer into Province hospital in South Borneo. The inclusion criteria were patient who admitted to Intensive care unit of DHAAN Hospital, rejected to refer into Province Hospital. The exclusion criteria were patient with incomplete medical record and seTBI patient whose family rejects to enter intensive care unit. GCS score was collected from Emergency department medical record written by the general practitioner. The GCS score as follows: 1) severe (score of 8 or below); 2) moderate (score of 9 to 13); 3) mild (score of 14 to 15). The GCS was used to categorize the outcome on discharge which differentiates into good recovery, moderate disability (disabled but independent), severe disability (conscious but dependent), persistent vegetative state, and death.

RESULT

The total of 372 cases of TBI were admitted to DHAAN Hospital from 1st January – 31th December 2016. The TBI grading was divided into three categories which are mild TBI, moderate TBI, and severe TBI. Mild TBI was counted 263 cases (69.8%), moderate TBI was 79 cases (18.5%), and severe TBI was counted 47 cases (11.7%). (table 1). The highest number of TBI occurred in January (38 cases). Table 1 also shows cases of TBI that dominate is a miTBI with 263 cases.

All of the patients received conservative therapy. Patient with seTBI in ICU treated with ventilators to maintain adequate oxygenation for vital organ hypoxia therapy. Sedation is indicated for the anxious patient with TBI, but all patient with seTBI who require mechanical ventilation will need deep sedation to optimize the therapy. In this case all patients were given thiopental 0.5-1.5mg/kg drip. Normovolemia was ensured at all times by administration of crystalloid fluid. The patients also given antibiotic ceftriaxone 1-2 gr per 24 hours for prevention of infection.

There are only 5 cases of seTBI were treated until discharge in the intensive care unit of DHAAN Hospital in 2016. The patient admitted in March, July, October, and December. Two patients were admitted in October. All of the patients experienced motor cycle accidents before the incidence of seTBI.

In total, 44% of patients had hypotension, and 70% required the use of vasoactive drugs at some point during the ICU stay. In ICU, the conservative therapy was given by surgeon, internist, and intensivist. Gastric stress ulcers may be prevented using either H2 receptor antagonists or proton pump

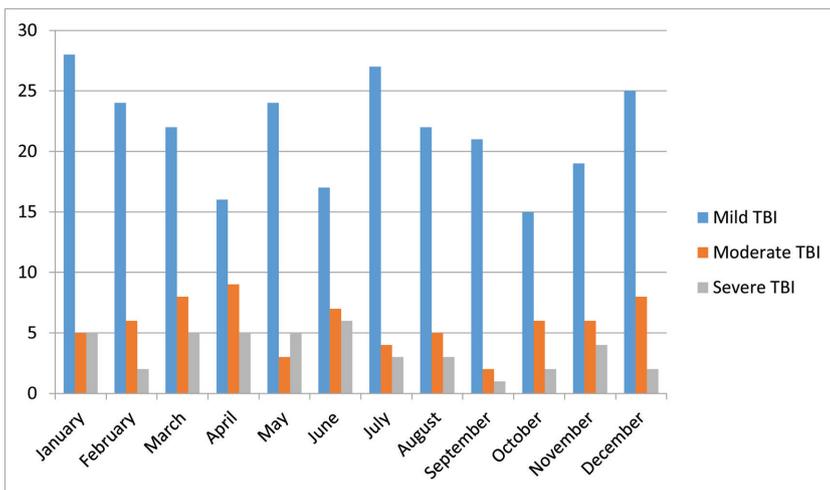


Table 1 Number of TBI in emergency department DHAAN Hospital from January -December 2016

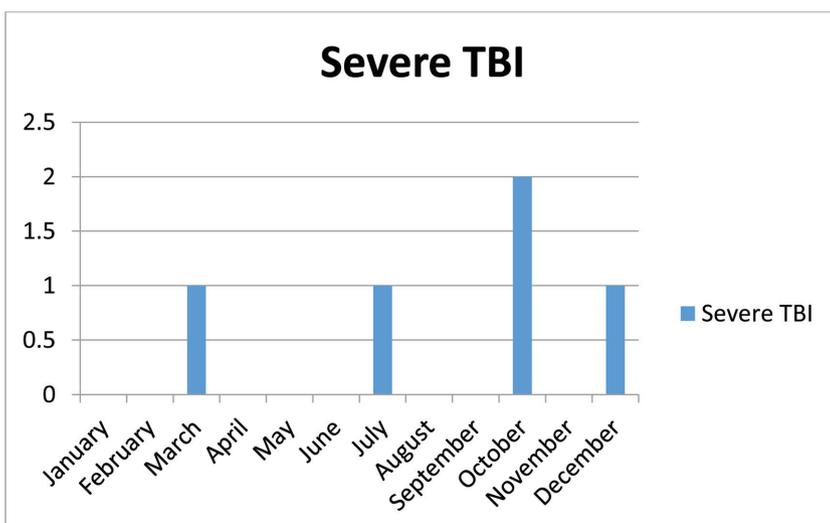


Table 3 The range of age patients with seTBI in ICU DHAAN Hospital January – December 2016

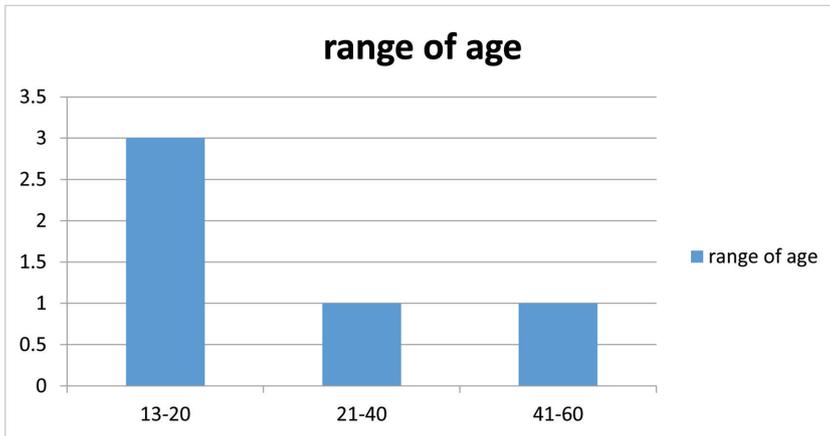


Table 2 Number of seTBI treated until discharge in Intensive care unit of DHAAN Hospital in 2016

inhibitors (PPIs). In this study most of the patients received ranitidine 50mg-150mg/24 h to prevent the stress ulcer.¹⁴ Inotropic administration such as norepinephrine 0.1-0.5 µg/kg drip combined with dobutamine 10-20 µg/kg drip to maintain the mean arterial pressure between 50-65 mmHg.

The patient with seTBI can be classified into 3 groups of age, namely group 1(13-20 years), group 2(21-40 years), and group 3 (40-60 years). The total patient with seTBI was 3 patients in group 1 (13-20 years), 1 patient in group 2(21-40 years), and 1 patient in group 3 (41-60 years), most of the patients are in the age range 13-20 years.

DISCUSSION

Most of the seTBI patient was teenagers and young adult. Meanwhile the incidence of seTBI in adult and elderly is 1 : 1. It may be caused by teenagers and young adult still have passionate and uncoordinated energy in riding the motorcycle. Most traffic violations also carried out by teenagers, meanwhile adult is relative stable in riding motorcycle. Most elderly is victim of the motorcycle accident.

Sedation is indicated for the anxious patient with TBI, but all patients with seTBI who require mechanical ventilation, deep sedation may be beneficial. In DHAAN Hospital patients were given thiopental 0.5-1.5mg/kg drip. Thiopental is one of barbiturate class of drugs. Barbiturates are a class of drugs that act on the GABA_A receptor in the brain and spinal cord. Barbiturates have anesthetic, sedative, anxiolytic, anticonvulsant and hypnotic (anesthesia and analgesia) effect.¹⁰ Thiopental administration may also give an effect of ICP decreasing.^{9,10} Head up 30-45 may also help to reduce ICP.^{8,11} Normovolemia was ensured at all times which administration of crystalloid fluid.

The conservative therapy also administered ceftriaxone 1-2 gr per 24 hours for prevention of

infection. Infection, fever, and respiratory difficulties all increase the metabolic rate and exacerbate neuronal ischemia.¹² Prophylactic treatment of hyperthermia may mask an infectious brewing process. Ceftriaxone is a cephalosporin-class antibiotic selected for broad spectrum and more specific for gram-positive bacteria.¹³ Ceftriaxone administration is a therapeutic option because the price is achievable by the community and available in the rural area like Tanah Bumbu Regency.¹³

Gastric stress ulcers may be prevented using either H2 receptor antagonists or proton pump inhibitors (PPIs). One of these medications should be considered for gastric stress ulceration prophylaxis in seTBI patients, although the tendency for H2 blockers to cause thrombocytopenia may limit their usefulness. In patients received ranitidine 50mg-150mg/24 h.^{14,15} Inotropic administration such as norepinephrine with a dose of 0.1-0.5 mcg/kg drip and combined with dobutamine 10-20 mcg/kg drip to maintain MAP 50-65 mmHg is expected to provide better outcomes. We found high mortality of TBI patients in ICU of DHAAN Hospital. All of the seTBI patients admitted to ICU were died after 2 days of treatment. The absence of neuroimaging will lead to uncomprehensive surgery or non-surgery treatment and monitoring post operation. The absence of neurosurgeon also worsening the condition. Competent health workers and neuroimaging will optimized the treatment given.^{16,17}

Boniface et al. reported that the priorities are to prevent hypoxia and hypotension, both common findings after TBI management. Even a single episode of hypotension is associated with increased morbidity and doubling the mortality risk.¹⁴ Coral et al. reported that in patients with seTBI, high rates of hemodynamic instability were found.¹⁵ This finding is related with this study. Santhanam et al. reported that early hypotension is an important predictor of outcome and can be reduced by efficient emergency medical services. The presence of hemodynamic instability (SBP<90 mmHg) during ICU stay is also an independent predictor of mortality. They suggest attempting to maintain both DBP> 70 mmHg and SBP >90 mmHg during transport and the in-hospital management of patients with head injury.¹⁶ Tobi et al. reported that mechanical ventilation is often indicated in patients with severe TBI to avoid hypoxia, which is defined as SpO₂ < 90% or PaO₂<60 mmHg, and to maintain normocarbida.¹⁷ Acute respiratory distress syndrome (ARDS)/ acute lung injury (ALI) can occur in 10-30% of patients with severe brain injury. But in their study 25% of patients seTBI with mechanically ventilated have higher mortality than control patients.^{17,18}

The incidence of pneumonia in patient with TBI is quite high. Antibiotic prophylaxis after 24h of

ventilation administration can increase late-onset pneumonia due to Gram-negative enteric bacilli and *Pseudomonas*.^{18,19} Prophylactic antibiotics on the first day of ventilation however decrease the incidence of ventilator-associated pneumonia and reduce the duration of ICU stay. This finding also supported the standard operational procedure in DHAAN Hospital.

CONCLUSION

Providing neurocritical care is important to reduce mortality or morbidity rate of TBI. In this study we found high mortality rate in cases of seTBI in ICU DHAAN Hospital, Tanah Bumbu Regency. There are several reasons for this bad clinical outcome of TBI: 1) The absence of neuroimaging modality such as CT scan, 2) the limitation of other medical facilities for ICP monitoring, 3) the absence of neurosurgeon in DHAAN Hospital. All of the limitations will lead to uncomprehensive treatment, especially surgical treatment. We suggest to the Government of Tanah Bumbu Regency to improve the medical facilities for reducing morbidity and mortality of TBI cases in this region.

CONFLICT OF INTEREST

Author declares there is no conflict of interest regarding all aspects of the study.

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