

Original Research Report**TRAUMATIC BRAIN INJURY PATIENTS IN THE EMERGENCY UNIT OF A TERTIARY HOSPITAL**

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ABSTRACT

Traumatic brain injury (TBI) is a prevalent neurological condition in emergency units. TBI cases are frequently diagnosed with severe conditions. Underdiagnosis is common in mild TBI cases. As a result, physicians have an uncomprehensive understanding of patients' characteristics in their daily practice. This study aimed to discuss the characteristics of trauma patients who were diagnosed with TBIs in an emergency unit. We conducted a retrospective cohort observational study to examine the adult population of TBI patients from April 2022 to March 2023. This study collected several data points, including demographics, clinical characteristics, surgical procedures, and disposition distribution. All variables were compiled and summarized using descriptive statistics and analyzed by calculating frequencies and percentages. During the period of this study, 483 trauma patients were admitted to the emergency unit. A total of 361 (74.7%) of these cases were identified as TBIs. Most of the traumatic brain injuries occurred in men (75.6%), with the predominant age range being 18–22 years (22.4%). Mild TBI cases (74.5%) were the most prevalent, followed by moderate (20.2%) and severe (5.3%) TBI cases. The average score from the Glasgow Coma Scale assessment was 15. Most patients (80.9%) had no hypotension, while a greater number of patients (98.1%) did not exhibit hypoxia as a comorbidity. The Injury Severity Score revealed that the highest percentage of TBIs was categorized as minor (62.3%). It was found that 53.5% of the patients were discharged, while 36% of the patients were hospitalized. However, seven patients (1.9%) passed away in the emergency unit, and 30 patients (8.3%) opted to be discharged against medical advice. Only 21 patients (5.8%) received neurosurgical management. As the most prevalent trauma, TBI necessitates careful management to handle the implications of clinical decision-making. It is crucial to investigate the underlying risk of mortality in TBI cases because the majority of patients do not require neurosurgical intervention.

Keywords: Emergency unit; health system; patient characteristics; traumatic brain injury

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Highlights:

1. The main focus of this study was to underscore the importance of exploring the characteristics of traumatic brain injury (TBI) patients, which have not been extensively investigated, to help establish effective clinical procedures and decisions.
2. Three out of every four trauma patients in the emergency unit had mild TBIs, and those who did not survive showed a significant trend of rapid deterioration.
3. It is crucial to consistently conduct a thorough and comprehensive head-to-toe examination for all trauma patients.

INTRODUCTION

Traumatic brain injury (TBI) is a neurological emergency that has become a global public health problem. Around 50–60 million people experience TBI annually (Steyerberg et al. 2019, Maas et al.

2022). A study in California, USA, found that the incidence of TBI in emergency units increased by over 50% during the last ten years. This condition causes high rates of disability and mortality worldwide, especially in low- and middle-income countries. TBI burdens healthcare systems and

economies through lost productivity, high healthcare costs, and long-term care (Watanitanon et al. 2018, Hsia et al. 2018).

TBI is a heterogeneous condition in terms of causes, severity, and outcomes. Regarding severity, TBI is categorized into three clinical types: mild, moderate, and severe. Many clinicians focus on moderate and severe TBIs, as they are more serious than mild TBIs. This situation makes mild TBIs underdiagnosed. TBI patients, including those with mild TBIs, may experience sequelae after discharge. Consequently, their functional condition will not be the same as before the injury (Dewan et al. 2019, Pozzato et al. 2020, Hago et al. 2022).

Due to the lack of data collection on patient characteristics, clinicians will not be able to understand TBI comprehensively and will hesitate to make clinical decisions in an emergency setting. In addition, understanding the characteristics of TBI is the key to determining management and assessing patient prognosis, especially in emergency units (Maas et al. 2022). Therefore, this article aims to provide an overview of the characteristics of TBI patients in the emergency unit.

MATERIALS AND METHODS

This observational study used a retrospective cohort design to examine trauma patients who received treatments at the emergency unit of Rumah Sakit Umum Pusat Nasional Dr. Cipto Mangunkusumo, a tertiary teaching hospital located in Jakarta, Indonesia. The study was conducted from April 2022 to March 2023. We collected data from patient medical records. The inclusion criteria were patients aged 18 years or older who were diagnosed with TBI upon admission to the emergency unit. The exclusion criteria were patients with incomplete data that could not fulfill the necessary variables (Ghandour et al. 2022).

Several data points were collected during the course of this study, such as demographic information, clinical characteristics, surgical procedures, and disposition distribution. One of the clinical variables examined in this study was TBI severity, which was assessed using the Glasgow Coma Scale score. A total score of 3–8 was indicative of a severe TBI, while score ranges of 9–12 and 13–15 indicated a moderate and mild TBI, respectively. Other variables were also documented in this study, including the classification of systolic blood pressure of <110 mmHg as hypotension and the classification of oxygen saturation of $\leq 90\%$ as hypoxia (Gaitanidis et al. 2021, Eom et al. 2021).

All data were analyzed by calculating frequencies and percentages using IBM SPSS Statistics version 25.0. The analysis results were presented descriptively in the form of tables and figures (Steyerberg et al. 2019). The Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia - Rumah Sakit Umum Pusat Nasional Dr. Cipto Mangunkusumo, Jakarta, Indonesia, granted approval for this study with registration No. KET-629/UN2.F1/ETIK/PPM.00.02/21 on 21/06/2021.

RESULTS

As shown in Table 1, there were 483 trauma patients admitted to the emergency unit during the study period. Approximately 361 (74.7%) of the patient population presented with TBIs, with nearly three cases in every four patients. Among those TBI patients, males (75.6%) were three times more common than females (24.4%). The histogram shows that the patients' median age was 34, with a range spanning from 18 to 84 years (Figure 1). This median indicated a prevalence of TBIs in the productive age group.

Table 1. Characteristics of the TBI Patients (n=361).

Variables	Classification	Number	%
Sexes	Male	273	75.6
	Female	88	24.4
TBI severity	Mild	269	74.5
	Moderate	73	20.2
	Severe	19	5.3
	GCS score	15 (3–15)*	
Hypotension	Yes	69	19.1
	No	292	80.9
Hypoxia	Yes	7	1.9
	No	354	98.1
Injury Severity Score	Minor (1–8)	225	62.3
	Moderate (9–15)	87	24.1
	Serious (16–24)	31	8.6
	Severe (25–49)	16	4.4
	Critical (50–74)	0	0
	Unsurvivable (75)	2	0.6
Neurosurgical management	Yes	21	5.8
	No	340	94.2
Outcome disposition	Discharged	193	53.5
	Discharged against medical advice	30	8.3
	Hospitalized	131	36.3
	Death	7	1.9

Notes: *Median (minimum-maximum). Traumatic brain injury (TBI). Glasgow Coma Scale (GCS).

According to the level of severity, this study found that mild TBIs were the most common, with approximately 296 patients (74.5%). This was followed by moderate TBIs in 73 patients (20.2%) and severe TBIs in 19 patients (5.3%). In the measurement of the patients' level of consciousness using the Glasgow Coma Scale, the average score was 15.

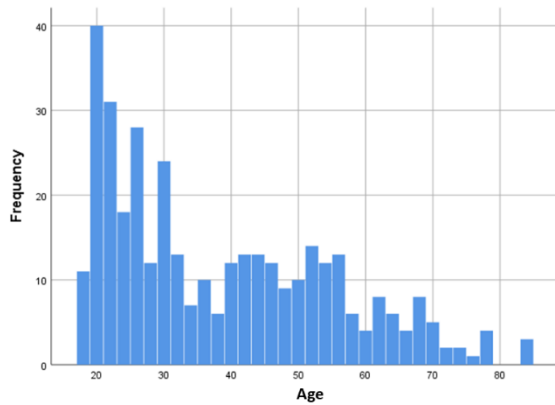


Figure 1. Age distribution of the TBI patients.

Regarding the severity and complications of TBI, nearly one-fifth of the patients had hypotension (19.1%). Furthermore, most patients did not experience hypoxia (98.1%). According to the assessment using the Injury Severity Score (ISS), the majority of TBI patients were classified as having minor severity (62.3%), with the subsequent highest classification being moderate severity (24.1%).

Within the population of TBI patients, there was a deficient proportion of TBI patients who were managed surgically (5.8%). Regarding disposition, a total of 193 patients (53.5%) were discharged. A smaller proportion of patients (36.3%), with a total of 131 individuals, were admitted to the hospital. It is worth noting that seven patients (1.9%) died in the emergency unit and 30 patients (8.3%) were discharged against medical advice (DAMA). Among seven deceased individuals in the emergency unit, three were categorized as suffering from severe TBIs, three were classified as having moderate TBIs, and one was identified as having a mild TBI.

DISCUSSION

This study can provide novel descriptive data regarding TBIs in real-world situations, especially in low- and middle-income countries. In the span of one year, a total of 483 trauma patients were admitted to the emergency unit, out of which 361 individuals were diagnosed with TBIs. This observation illustrated that on a daily basis, the emergency unit received approximately one to two trauma patients. Three out of four trauma patients experienced TBIs. Most patients in our research were under the age of 60. This observation aligned with other studies that had identified a high incidence of TBIs within younger adult populations (Putra et al. 2021, Magalhães et al. 2022). This was also consistent with the findings of a study

conducted at a referral hospital in Uganda. The study revealed that the majority (68%) of TBI patients fell within the age range of 18–50 years (Luggya et al. 2022). However, it should be noted that different studies had presented data suggesting that age variations might arise due to differences in inclusion criteria, such as population coverage, mechanism of injury, or other criteria as defined by the respective studies (Peeters et al. 2015, Skaansar et al. 2020, Brazinova et al. 2021).

The results of our study indicated a higher prevalence of TBIs among males (75.6%). The finding was supported by multicenter epidemiological studies conducted in European countries and Korea. According to one of the previous multicenter studies, men had a higher likelihood of being employed in occupations that included a greater risk of injury or hazardous behaviors, hence making them more vulnerable to sustaining injuries (Peeters et al. 2015, Eom et al. 2021). The analysis of demographic data revealed that TBIs disproportionately impacted males within the most productive age group. This condition significantly affected their socioeconomic status, as they often take on the role of the primary breadwinner in their families. The family's financial condition would be disrupted due to their inability to earn income (Zia et al. 2019, Lee et al. 2021, Luggya et al. 2022). Traumatic brain injuries (TBIs) have been deemed a major contributor to the economic burden imposed on the healthcare system, in addition to patients, their families, communities, and the country. It has been estimated that TBIs incur an annual economic cost of approximately US\$400 billion on a global scale (Maas et al. 2017, Howe et al. 2022).

In this study, the majority of the patients experienced mild TBIs. These findings were similar to those observed in research conducted across 18 European countries through the Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury (CENTER-TBI) (Steyerberg et al. 2019, Hagos et al. 2022). A study conducted in Africa demonstrated a positive correlation between the severity of TBI and mortality rates. The study found that the distribution of severity levels was 25% for severe cases, 8.0% for moderate cases, and 2.0% for mild cases (Hagos et al. 2022). The mortality rates associated with mild TBIs are low. Nevertheless, it is noteworthy that around a quarter of patients in the emergency unit and half of hospitalized patients diagnosed with mild TBIs do not fully recover within six months. This illness creates a significant social burden for healthcare services and affects individuals' functional recovery and quality of life (Dewan et al. 2019, Gao et al. 2020, Magalhães et al. 2022).

Hypotension and hypoxia are identified as risk factors that contribute to the increased mortality associated with TBIs. Both disorders have the potential to result in secondary brain injury (Aninditha & Wirataman 2017, Spaite et al. 2017, Rauch et al. 2021). The findings of our study showed that most of the patients did not exhibit symptoms of hypotension or hypoxia. This condition was related to the disposition of our patient population, wherein the mortality rate was only 1.9% within the emergency unit. According to a study conducted in Boston, USA, it was shown that there is an association between systolic blood pressure levels of ≥ 110 mmHg and a decrease in hospital mortality rates among adult patients with TBIs, including individuals between the ages of 50 and 69. According to the Brain Trauma Foundation guidelines, individuals aged 50–69 years should maintain a systolic blood pressure of at least 100 mmHg, while those aged 15–49 and >70 years should aim for a systolic blood pressure of at least 110 mmHg (Carney et al. 2017, Gaitanidis et al. 2021). Hypoxic conditions have the potential to induce irreversible brain injuries. The brain injuries may persist until the onset of cerebral anoxia (Ankita et al. 2015, Zairinal 2022). However, the results of our study were incomplete in terms of providing a comprehensive description of the patients' systolic blood pressure and oxygen saturation due to the absence of clear documentation pertaining to these variables before or after resuscitation.

According to the Injury Severity Score assessment results, most patients in this study had a score of <16 . This observation might be attributed to the high prevalence of individuals receiving outpatient care and presenting with mild TBIs. Nevertheless, an Injury Severity Score assessment result of ≥ 16 cannot be used as a reliable indicator for identifying patients who are at a high risk of mortality. The assessment of mortality risk should be conducted on an individual basis with a clinical evaluation (Girshausen et al. 2022, Colnaric et al. 2022, Dehouche 2022).

The present study observed a relatively low proportion of patients who required neurosurgical management. The large number of mild TBI patients in this study indicated that there was almost certainly no requirement for neurosurgical intervention. Out of a total of 92 patients diagnosed with moderate and severe TBIs, only 19 individuals underwent surgery. The analysis of the data revealed that the precise timing of stabilization, monitoring, and further therapies play a critical role in mitigating morbidity and mortality, hence enhancing patient outcomes (Valle et al. 2022, Zairinal 2022, Picetti et al. 2023)

Through examining the deceased TBI patients, it was observed that there was an evident trend

wherein patients with moderate TBIs showed a tendency for rapid deterioration. Either moderate or severe TBIs must be treated aggressively and by involving many resources. These resources include reliable personnel specializing in caring for critical neurological patients, the availability of intensive care unit (ICU) beds, and the implementation of a multimodal neuromonitoring approach. Moreover, it is essential to provide thorough and comprehensive care to trauma patients, ensuring a full examination and treatment from head to toe, particularly in mild TBI cases (Watanitanon et al. 2018).

Strength and limitations

This study has the potential to contribute to the current collection of research as a novel descriptive data study focusing on traumatic brain injuries (TBIs) in emergency settings and real-world situations, specifically in low- and middle-income countries. The present study provides an analysis of the patients' trajectory within the emergency unit, including their admission and discharge, based on the clinical data obtained. In accordance with the analysis, it is crucial to take into account the duration of management for TBIs, as it can affect the later stages of hospitalization and rehabilitation. However, several cases of discharge against medical advice limited the potential of the data to comprehensively describe the clinical profiles of TBI patients. Additionally, this study was unable to obtain additional important clinical data, such as pupil reactivity, patient consciousness, and blood pressure, that were uncertain between pre- and post-resuscitation. Further research is required in order to present more comprehensive characteristics of TBI patients.

CONCLUSION

This study has identified mild traumatic brain injuries (TBIs) as the most prevalent among those within the most productive age group, with a higher prevalence observed in men than women. While a considerable number of patients did not require neurosurgical interventions and were subsequently discharged, it is important to note that several patients died in the emergency unit. Failure to perform a brief neurologic examination during the primary survey of trauma patients may indicate only the tip of the iceberg.

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Conflict of interest

None.

Ethical consideration

This research was ethically approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia - Rumah Sakit Umum Pusat Nasional Dr. Cipto Mangunkusumo, Jakarta, Indonesia, with registration No. KET-629/UN2.F1/ETIK/PPM.00.02/21 on 21/06/2021.

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Author contribution

RAZ contributed to conceptualization, study design, formal analysis, data interpretation, methodology, provision of study materials, funding acquisition, supervision, manuscript writing, and content revision. CNM contributed to data gathering, manuscript writing, and project administration. YR, DNL, AM, and PP contributed to conceptualization, study design, formal analysis, data interpretation, methodology, supervision, manuscript writing, and content revision.

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