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Clinical Characteristics of Traumatic Brain Injury (TBI) Patients in Grha Bhakti Medika Hospital from 2020-2024 : Clinical Outcome from a Trauma Center in East Bali

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ABSTRACT

Introduction: Head trauma is a common emergency department presentation, yet epidemiological data on traumatic brain injury (TBI) remains limited. This study aimed to evaluate the clinical characteristics and outcomes of TBI patients at Grha Bhakti Medika Hospital.
Methods: A retrospective cohort study was conducted on TBI patients treated between July 2020 and June 2024. Data from medical records were analyzed, with chi-square tests performed to identify predictors of in-hospital mortality.
Results: A total of 159 TBI cases were recorded, predominantly male (54.1%) and aged 19-40 years (32.1%). Isolated head trauma was most common (81.1%), and traffic accidents accounted for 62.2% of injuries. Non-referral cases (55.9%) exceeded referrals (44.1%). Most patients had no prior head trauma (98.2%), were conscious on admission (50.9%), had mild TBI (GCS 13-15, 80.6%), and showed no airway obstruction or oxygen desaturation (97.5%). Blunt injuries (94.3%), absence of intracranial bleeding (56.6%), and conservative treatment (64.1%) were predominant. Significant predictors of in-hospital mortality included unconscious history, duration of unconsciousness, GCS at admission, types of intracranial bleeding, and treatment modality.
Conclusion: TBI patients were predominantly young males with isolated, traffic-related injuries and mild clinical presentations. Key factors such as unconsciousness, GCS, and intracranial bleeding types significantly influenced mortality. These findings emphasize the need for targeted interventions to improve TBI outcomes.
Keyword: Head injury, traumatic brain injury, mortality

1. Introduction

Head injuries are frequently encountered in emergency departments.[1] Traumatic brain injury (TBI) is a non-degenerative, non-congenital condition resulting from external mechanical forces affecting the scalp, skull, facial bones, or brain.[1-3] It caused by traumatic process with or without intracranial bleeding.[4] TBI can caused by both blunt or sharp violence; the most common causes are traffic accident and fall from height which included in blunt trauma.[5] Many patients with severe TBI die before reaching hospital, with nearly 90% of prehospital trauma-related fatalities involving TBI.(1) Survivors of TBI often experience neuropsychological impairments that lead to disabilities affecting their work and social activities.[1]

The World Health Organization (WHO) reports that approximately 1.2 million people die with the diagnosis of severe TBI resulting from traffic accident. It is estimated that by 2025, TBI are the most significant cause of death and disability in the world.(2) The incidence of TBI in Indonesia increased from 2007 − 2018. These incidents occurred more frequently at the ages of 15 – 24 years (12.2%) and 5 – 14 years (12.1%).[6] Traffic accidents in developing countries, particularly Indonesia, contribute significantly to pedestrian and cyclist fatalities, with a mortality rate of 25-37%.[7] In Bali Province, based on study conducted by Niryana et al in Sanglah General Hospital, TBI caused by traffic accidents predominantly affects men and individuals aged 19 to 40 years. [4]

Epidemiological study about traumatic brain injury are still limited. Knowing the clinical characteristics is important because it can help provide more effective diagnosis and management. In the future, it can also intervene in the form of public health regulation and prevention action. Grha Bhakti Medika Hospital is located on Bypass Ida Bagus Mantra road, Banjarangkan, Klungkung Bali, Indonesia. As a trauma center hospital which has been operating since July 2020, we also provided neurosurgical sevices which still limited in east Bali region. This study determines the clinical characteristics of TBI patients who undergoing surgical management in Grha Bhakti Medika Hospital (single-centered) and its clinical outcomes.

2. Methods

We conducted a retrospective cohort study of all patients treated for traumatic brain injury at Grha Bhakti Medika hospital from July 2020 until June 2024. Samples were collected using a non-random sampling method. The diagnosis is made based on clinical presentation and pre-operative CT scan. The inclusion criteria that applied in this study were patients diagnosed with TBI (based on the ICD-10 code; we included patient with these codes : S06.0 intracranial injury, S06.1 for traumatic cerebral edema, S06.2 for diffuse traumatic brain injury, S06.3 for focal traumatic brain injury, S06.4 for epidural hemorrhage, S06.5 for traumatic subdural hemorrhage, S06.6 for traumatic subarachnoid hemorrhage, S06.8 for other specified intracranial injuries, S06.9 for unspecified intracranial injury, S06.A for traumatic brain compression and herniation, S02.0 for fracture of the vault of the skull, S02.1 for fracture of the base of the skull, and S01.9 for open wound of the head, unspecified part. Only patients with complete and accessible medical records were included in the study.

Data was obtained through review of the medical records, which encompassed each patient's demographic details, mechanism of injury, history of prior injuries, prehospital condition, type of head injury, type of bleeding, and in-hospital mortality. The prehospital condition includes information on any loss of consciousness prior to hospital admission, the duration of unconsciousness, and the time taken to reach the hospital, starting from the moment of the initial accident. Upon arrival at the emergency department, the level of awareness, presence of airway obstruction, and signs of impaired oxygen circulation were assessed in the patients.

The level of consciousness was evaluated using Glasgow Coma Scale (GCS) which divided into mild (GCS 14-15), moderate (GCS 9-12), and severe (GCS 3-8). Then, preoperative CT-scan was used to evaluate the number and type of intracranial haemorrhage. Status of oxygen circulation in blood was measured using peripheral oxygen saturation.

We conducted a chi square test to analyze differences in categorical variables related to patient care outcomes, specifically in-hospital mortality. A p-value of less than 0.05 was considered statistically significant. The analysis was conducted using SPSS version 29.0 (SPSS Inc., Chicago, IL, USA).

3. Result

The total number of TBI patients at Grha Bhakti Medika Hospital during July 2020 − June 2024 based on existing medical record data were 159 cases with male (86 cases (54.1%) and 19-40 years of age group (51 cases (32.1%)) dominance. More patients came with isolated head trauma (129 cases (81.1%)) than multi trauma (30 cases (18.9%)). Based on the mechanism of injury, traffic accident still leading with 99 number of cases (62.2%) followed by fell down at home (27 cases (16.9%)), other causes (22 cases (14%)), and fell from height (11 cases (6.9%)) at last. We received more not-referral patients in our hospital with total 89 cases (55.9%) than referral patients (70 cases (44.1%)). From the referral data, patient dominantly referred from Karangasem Regency (58 (82.8%)), followed by Gianyar Regency (9 cases (12.8%)), Bangli Regency (2 cases (2.8%)), and Klungkung Regency (1 cases (1.4%)). All of the demographic datas are presented in the infographic below.

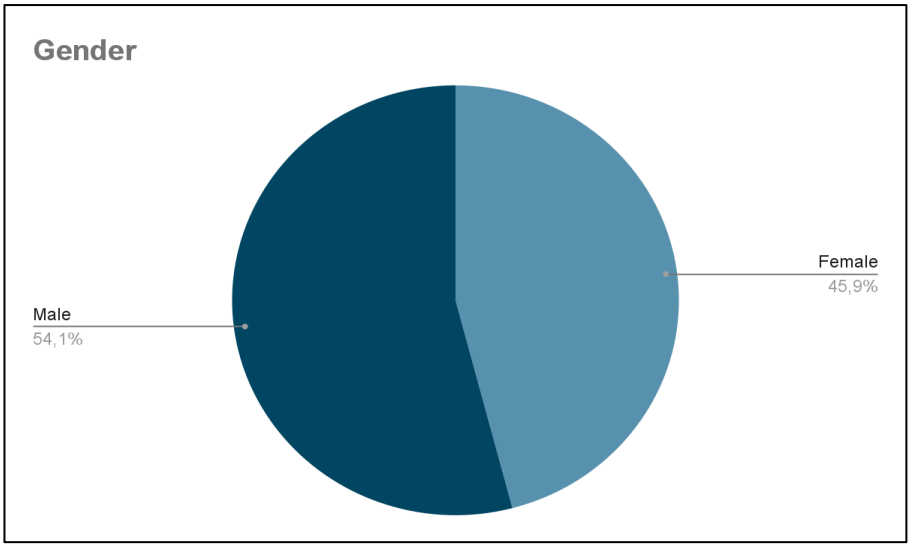

Figure 1. Gender Variable Demographic Data

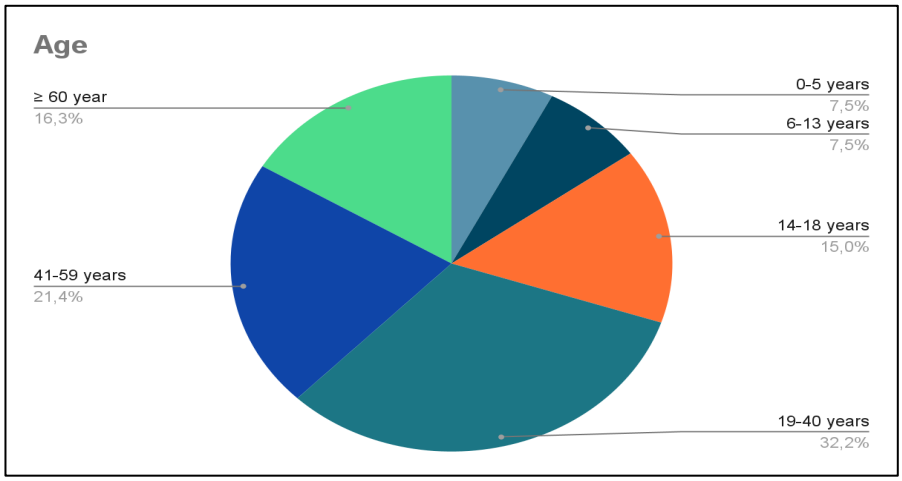

Figure 2. Age Variable Demographic Data

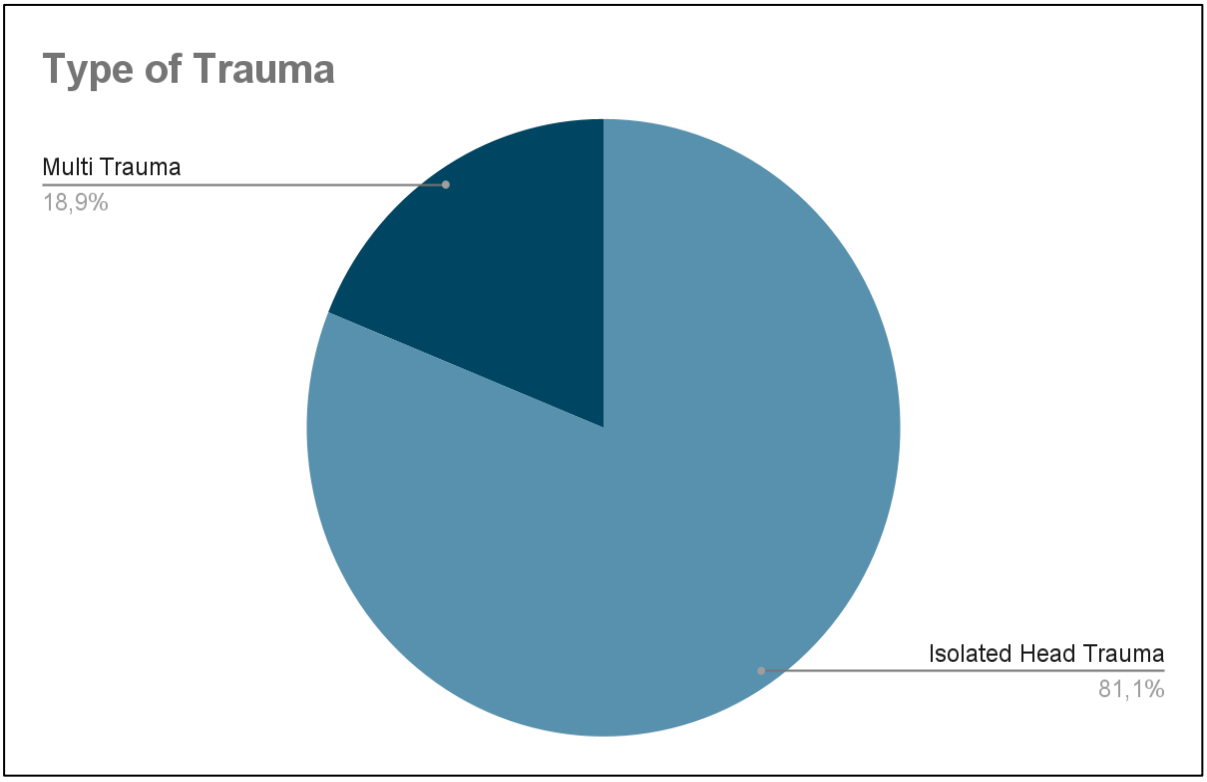

Figure 3. Type of Trauma Demographic Data

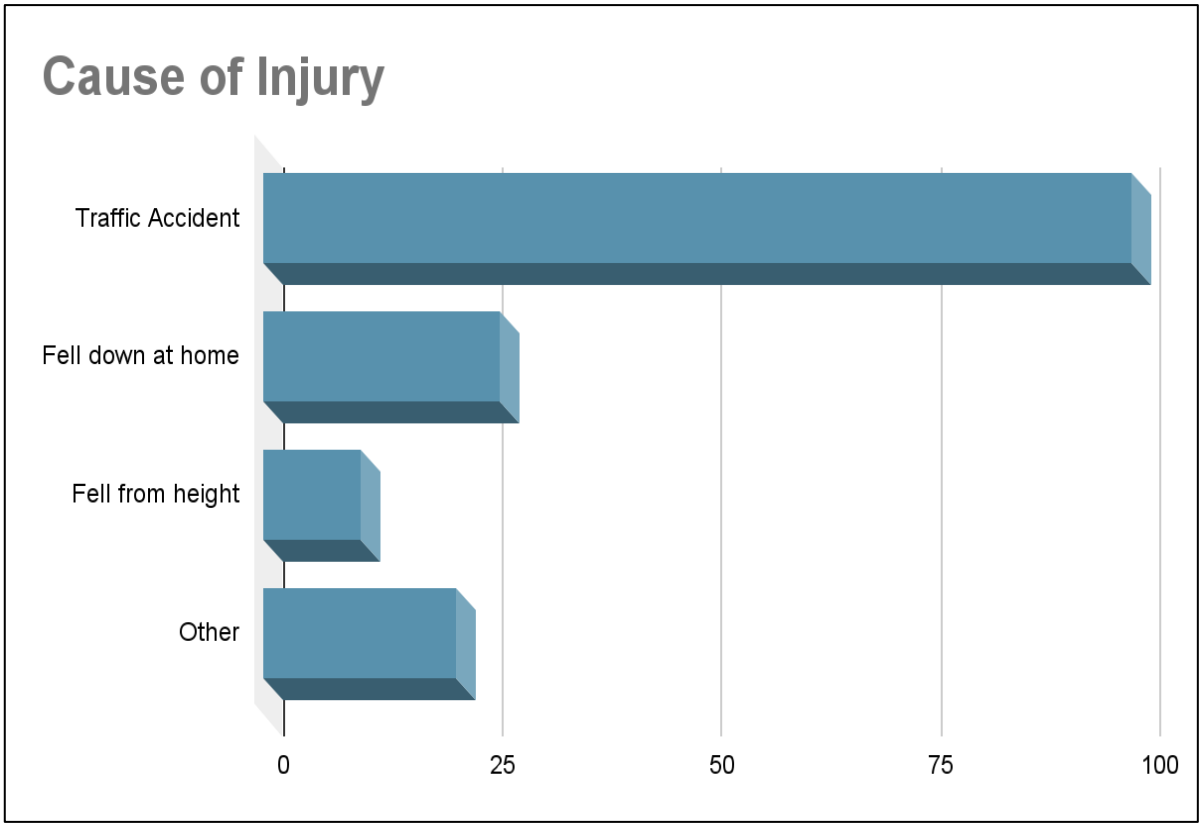

Figure 4. Cause of Injury Demographic Data

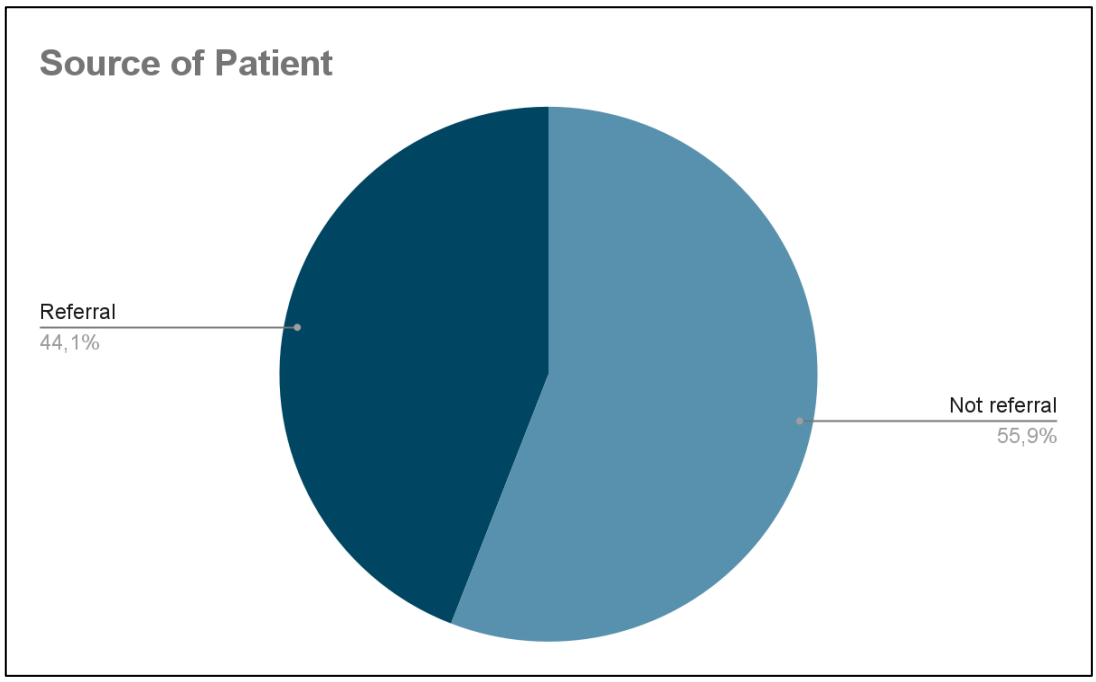

Figure 5. Source of Patient Demographic Data

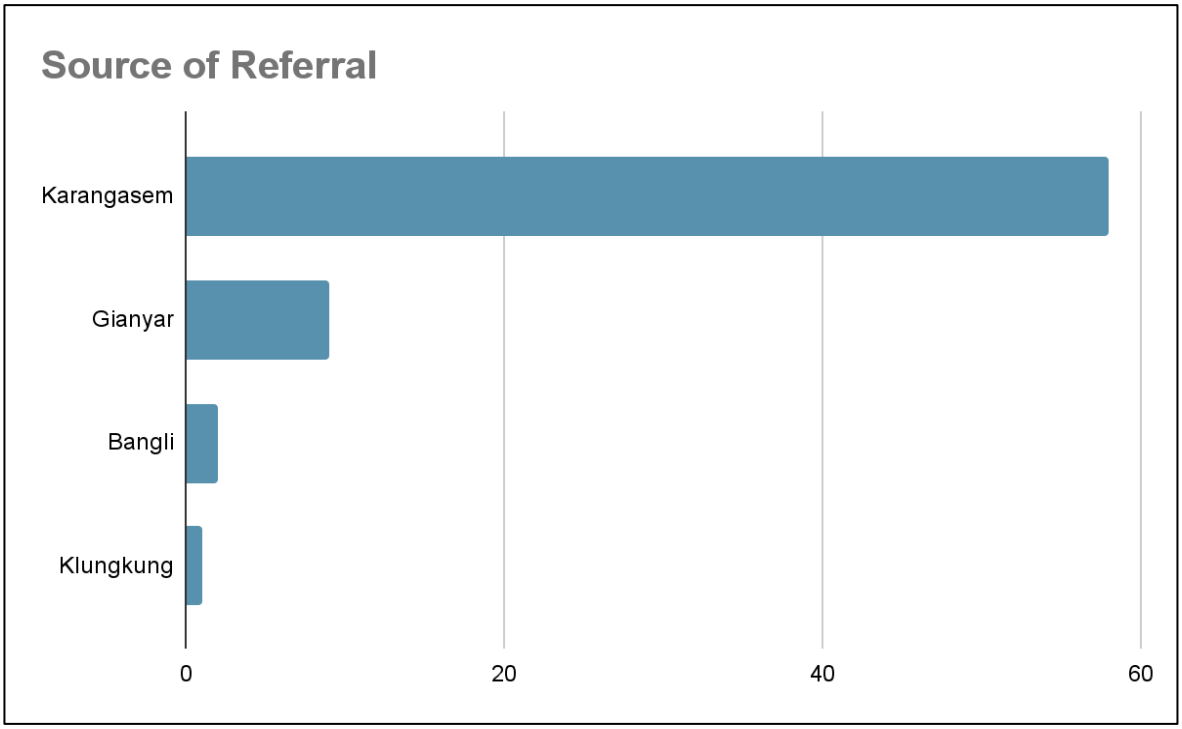

Figure 6. Source of Referral Demographic Data

Data from the physical examination carried out in our emergency ward shows that patients are commonly came with no history of head trauma before (156 cases (98.2%)), in-conscious state (81 cases (50.9%)), with 13-15 total GCS admission (128 cases (80.6%)), no airway obstruction nor oxygen saturation decreasement (155 cases (97.5%) each), blunt injury 150 (94.3%), no intracranial bleeding (90 cases (56.6%)), and underwent conservative as the treatment option (102 cases (64.1%)). The variable of clinical characteristics and in-hospital mortality output were shown in table 1 below.

Table 1. Variable Clinical Characteristics and In-Hospital Mortality Output

Variable	In-Hospital Mortality		Total	p-Value
	Died	Not Died		
History of Head Injury				0,707
Yes	0	3 (100%)	3 (1.8%)	
No	7 (4.5%)	149 (95.5%)	156 (98.2%)	
Unconscious History				0,005*
Yes	7 (9.1%)	70 (90.9%)	77 (48.4%)	
No	0	82 (100%)	82 (51.6%)	
Duration of Unconsciousness				0,009*
Conscious	0	81 (100%)	81 (50.9%)	
< 10 minutes	2 (4.7%)	40 (5.3%)	42 (26.4%)	
10-60 minutes	4 (14.8%)	23 (85.2%)	27 (16.9%)	
> 1 hour	1 (11.1%)	8 (88.9%)	9 (5.6%)	
Time Interval to Hospital				0,473
< 1 hour	1 (1.7%)	56 (98.3%)	57 (35.8%)	
1-4 hour	4 (5.8%)	66 (94.2%)	70 (44%)	
5-12 hour	2 (6.3%)	30 (93.7%)	32 (20.2%)	
> 12 hour	0	0	0	
GCS admission				< 0,001*
3-8	4 (30.7%)	9 (69.3%)	13 (8.1%)	
9-12	0	18 (100%)	18 (11.3%)	
13-15	3 (2.4%)	125 (97.6%)	128 (80.6%)	
Airway obstruction				0,664
Yes	0	4 (100%)	4 (2.5%)	
No	7 (0.3%)	148 (99.7%)	155 (97.5%)	
O2sat < 90%				0,042
Yes	1 (25%)	3 (75%)	4 (2.5%)	
No	6 (3.8%)	149 (96.2%)	155 (97.5%)	
Type of Head Injury				0,507
Blunt	7 (4.7%)	143 (95.3%)	150 (94.3%)	
Open	0	9 (100%)	9 (5.6%)	
Number of Types of Intracranial Bleeding				0,02*
Not at all	2 (2.2%)	88 (97.8%)	90 (56.6%)	
1 type	0	35 (100%)	35 (22%)	
2 types	5 (20%)	20 (80%)	25 (15.7%)	
3 types	0	8 (100%)	8 (5%)	
4 types	0	1 (100%)	1 (0.7%)	
Treatment Option				0,045*
Conservative	2 (2%)	100 (98%)	102 (64.1%)	
Surgery	5 (8.8%)	52 (91.2%)	57 (35.8%)	

*p < 0.05 shows statistically significant result

4. Discussion

In this study, it shows that males tended to experience more frequent TBI rather than female. Based on the age group, it also shows that patients who still in productive age (19-40 years) are the most common who experienced TBI. This is in accordance with prior study conducted by Niryana et al in Sanglah General Hospital, Denpasar, Bali in 2020. It could be influenced by factors of their higher activity, lack of personal protective equipment, and lack of caution when riding. Traffic accidents always remains the most common cause of TBI which also in accordance with this study result. Patients who came because of accidents can occur due to the collisions between motorized vehicles, single accidents, falling from a bicycle, being hit while walking, or falling from the passenger seats. This result is in contrast to global studies in developed countries, for example Europe and US. Among 13 million individuals estimated to have disabilities following TBI, there is a growing impact on those over 65 years old, which dominantly falling from low heights as mechanism of injury. In developed countries, the number of victims aged 15 to 44 involved in high-speed traffic accidents has decreased, thanks to better road conditions, stricter traffic regulations, and enhanced safety features in vehicles.[8,9]

We received more not-referral patients than referral. The location of our hospital which is on a very active 24/7 main road makes trauma as the most often cases received in the emergency unit. We also receive trauma cases referrals from other centers in East Bali region that require neurosurgery services. This is because neurosurgery services are still limited in the East Bali region till now. Neurosurgery services in Klungkung Regency itself are only provided by 1 neurosurgery specialist. Therefore, it is deemed necessary to improve neurosurgical services, especially in the East Bali area, so as to help improve TBI patients outcome.

Rapid examination that were conducted in emergency room based on the Advanced Trauma Life Support principal including primary survey and secondary survey revealed that we dominantly received patients with isolated head trauma than multi trauma. This is in line with the findings of this study which also found that more patients came with mild head injuries presentation. According to Bez et al, non-isolated TBI patients usually presented with more severe injuries and required more advanced care. The presence of additional extracranial injuries apart from TBI could have indirectly affected the brain, either by immediate mechanisms (e.g., injury to the great vessels) or by late complications (e.g., infections or organ failure).[10,11] It is believed that blood-brain disruption in TBI plays a main factor in the pathobiology of the brain following an injury, especially with concomitant injuries. It has been shown that peripheral inflammatory responses can cause the migration of leukocytes into the brain, exacerbating the neuroinflammatory response to a TBI. Therefore, the presence extracranial injuries can modify the outcomes of TBI casualties.[10,12]

Based on the chi square analysis, statistically significant findings were found in unconscious history, duration of unconsciousness, GCS admission. number of types of intracranial bleeding, and treatment option variables with in-hospital mortality output. Patients who are unconscious exhibit reduced alertness, diminished self-awareness, and impaired responses to external stimuli. Unconsciousness can arise from damage to the ascending reticular activating system, cerebral hemispheres, or various toxic, metabolic, or infectious factors.[13] Trauma is a major cause of unconsciousness observed in emergency departments. During periods of unconsciousness, patients lose their protective reflexes and sensory responses, making them susceptible to aspiration, anoxic brain injuries, airway obstruction, and skin ulcers.[14] Intracranial hemorrhage encompasses four primary types: epidural hemorrhage, subdural hemorrhage, subarachnoid hemorrhage, and intraparenchymal hemorrhage. This is in accordance with Perel et al's study result which stated that

it is plausible that the impact of intracranial hemorrhage can vary depending on its location, as the functional outcome is influenced by the specific brain region affected.[15] They also found that only large intracranial bleeding, wherever the location are associated with worse outcome and that large intracranial bleeding are associated with an increased risk of death in comparison with the smaller one.[15] Further study about these are warranted.

5. Conclusion

Most of TBI patients in Grha Bhakti Medika Hospital from July 2020-June 2024 are male with aged 19-40 years, isolated head trauma and traffic accident as the mechanism of injury. Clinical examination results showed that more patients came with the mild head injuries. There is assosciation between unconscious history, duration of unconsciousness, GCS admission. number of types of intracranial bleeding, and treatment option with in-hospital mortality output.

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