Characteristics of Moderate and Severe Traumatic Brain Injury of Motorcycle Crashes in Bandung, Indonesia

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BACKGROUND: **Traumatic brain injury (TBI) constitutes a critical public health and socioeconomic problem. As one of the leading causes of mortality and disability from road traffic crashes, the incidence of TBIs is increasing with increasing motor vehicle usage. Understanding the prevalence and describing the characteristics of TBI are crucial for successful implementation of prevention and treatment efforts to reduce the mortality and morbidity caused by TBIs.**

METHODS: **We studied cases of moderate and severe TBI resulting from motorcycle crashes from January 1, 2013 to June 30, 2014. Variables studied included sex, age, time interval (from crash to arrival at the emergency department), alcohol consumption, helmet use, severity of TBI, choice of treatment, and the outcome.**

RESULTS: **A total of 2108 head injury cases were seen at the emergency department during this period, 1324 (62.8%) of which resulted from motorcycle crashes. Of those cases, 30.7% (407 cases) were categorized as moderate or severe TBI with 29.2% mortality. Most of the patients were male (80.8%), <60 years old (96.1%), and did not wear a helmet (71.2%). More than half of the cases (56.7%) arrived at the emergency department within 6 hours, 14.0% of the cases were under alcohol intoxication, and 37.8% of the cases were operated on.**

CONCLUSIONS: **This preliminary analysis highlights the need to address road safety, especially with respect to helmet use and drink driving, to reduce the burden of TBIs in Bandung.**

BACKGROUND

Traumatic brain injury (TBI) constitutes a critical public health and socioeconomic problem and is among the leading causes of mortality and disability in many countries.[1] Globally, TBIs have been predominantly caused by road traffic injuries (RTIs), followed by falls and violence.[1] Increasing motorization, poor safety standards, and poor road infrastructure have contributed to the increase in road traffic crashes (RTCs) and related trauma.[2] Moreover, because of remoteness, transportation difficulties, and lack of appropriate and coordinated health care facilities in many low- and middle-income countries (LMICs), treatment and follow-up of patients are challenging and, in many instances, nonexistent.[3]

According to the World Health Organization, RTIs caused an unacceptably high 1.25 million deaths worldwide in 2013.[2] According to the Global Status Report on Road Safety, in 2013, only 28 countries, representing 449 million people (7% of the world's population), had adequate laws to address the 5 major risk factors (speed, drunk driving, helmets, seat-belts, and child restraints) for RTIs.[4] More than a third of road traffic deaths in LMICs are among pedestrians and cyclists. However, less than 35% of LMICs have policies in place to protect these road users.[4]

Around the world, more than 10 million people have TBIs serious enough to result in hospitalization or death each year.[1] Annually, approximately 1.7 million U.S. civilians had TBIs, of whom 1.4 million were treated at emergency departments.[5] Similarly, in the European Union, with 330 million inhabitants, approximately 7.7 million new cases of TBI occur each year,[6] and a recent review found that incidence rates remained broadly similar in the region.[7] In Indonesia, severe TBIs range between 6% and 12% of all TBI, with mortality ranging between 25% and

Key words
- Characteristics of traumatic brain injury
- Mortality
- Motorcycle

Abbreviations and Acronyms
GAP: Glasgow Admission Prediction
GCS: Glasgow Coma Scale
LMICs: Low- and middle-income countries
RSHS: Dr. Hasan Sadikin Hospital
RTC: Road traffic crash
RTI: Road traffic injury
TBI: Traumatic brain injury

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37%. Worldwide, TBIs are estimated to surpass many diseases as a major cause of death and disability by 2020.[1]

Indonesia is a densely populated lower middle-income country, with a population of 250 million people. Almost a quarter live in West Java Province, in an area of only 35.377 km^2. The population is spread among 26 districts and municipalities. In this densely populated region, the number of people using cars and motorbikes has increased considerably in recent years, contributing to an increasing number of patients with RTIs being treated in the region's hospitals.[8] Despite the increase in RTIs in the region, there has been a lack of data on the related burden and epidemiology of TBIs in Indonesia.

Understanding the circumstances that lead to TBIs and describing the characteristics of cases of TBI are key to laying the foundations for interventions made in the interest of public health and preventive medicine to reduce this burden. Furthermore, it is crucial for the planning of successful prevention campaigns and for appropriate allocation of resources.[9] This study aims to fulfill this goal through an analysis of cases of TBI presenting at the Dr. Hasan Sadikin Hospital (RSHS) in Bandung. We aim to describe the characteristics of patients with TBI, including demographics of patients with TBI, injury severity, types of TBIs sustained, and survival in hospital.

METHODS

This was a single-institution retrospective study at RSHS in Bandung, which serves the city; patients are also referred from West Java Province. RSHS in Bandung is one of 15 hospitals in West Java Province that have an emergency department and accompanying intensive care unit. The hospital has 900 beds and the neurosurgery unit admits on average 117 patients with trauma per month. Seriously injured patients are usually discharged to their own homes 1–2 weeks after surgery.

Data were collected of patients who presented to RSHS from January 1, 2013 to June 30, 2014. The inclusion criteria are a confirmed diagnosis based on the *International Classification of Diseases, Tenth Revision* definition of traumatic brain injury (Concussion S06.0) and an initial Glasgow Coma Scale (GCS) score of 13 or less. Patients with multiple traumas with an Abbreviated Injury Score $\geq$3 in another body region were excluded from the study. A database was constructed from review of the medical records, which included de-identified data for each eligible patient's demographic information, vital information, initial GCS score, helmet use severity, alcohol consumption, diseases diagnosed using computed tomography, operative management, 24-hour survival, and survival through hospitalization.

De-identified data were entered into Microsoft Excel 2010 and analyzed using Stata 14 (StataCorp, College Station, Texas, USA).[10] Exploratory data analyses were conducted. A χ^2 test was used to determine if distribution of hospital mortality was different for patient characteristics, time interval to the emergency department, severity of injury, and means of arrival. Bivariate logistic regression was performed to assess the relationship between each of these variables and hospital mortality. Multivariate logistic regression models were built to estimate the association between patient characteristics, means of arrival, injury severity, and hospital mortality. The Hosmer-Lemeshow

Table 1. Demographics and Means of Transport to Hospital of Patients with Traumatic Brain Injury

	Road Traffic Injuries									
	Car		Motorcycle		Pedestrian		Fall		Total	
	n	%	n	%	n	%	n	%	n	%
Age (n = 609) (years)										
<5	0	0.00	0	0.00	2	2.02	2	2.22	4	0.66
5–17	2	15.38	93	22.85	14	14.14	23	25.56	132	21.67
18–29	2	15.38	168	41.28	11	11.11	14	15.56	195	32.02
30–45	5	38.46	83	20.39	20	20.20	22	24.44	130	21.35
45–59	3	23.08	47	11.55	32	32.32	17	18.89	99	16.26
≥60	1	7.69	16	3.93	20	20.20	12	13.33	49	8.05
Sex (n = 609)										
Female	4	30.77	78	19.16	37	37.37	13	14.44	132	21.67
Male	9	69.23	329	80.84	62	62.63	77	85.56	477	78.33
Means of transport to hospital (n = 608)										
Other vehicle	3	25.00	66	16.22	19	19.19	29	32.22	117	19.24
Ambulance	9	75.00	341	83.78	80	80.81	61	67.78	491	80.76
Total	13	100	407	100	99	100	90	100	609	100