

Motorbike-Related Neurotrauma at a Neurosurgical Unit

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Abstract

Background : To analyze patterns of motorbike-related neurotrauma and to decipher where the current scenario can be best optimized.

Methods : In this descriptive, prospective, cross-sectional study, cases of motorcycle-accidents with neurotraumatic injuries were included. Variables noted were, age, mode of presentation, gender, type of head-injury, associated injury, outcome, type of rider, socioeconomic status, helmet-use, education-level, residence, mode of treatment, duration of hospitalization and permanent-disability. All patients were treated for their respective injuries and complications and were managed as per standard protocols.

Results : In 100 patients predominant age group was 14-29 years. Worse outcome was seen in rural residents and first-riders. Bleeds outnumbered fractures and concomitant orthopaedic injuries were the most common associated injury. Helmet use rate of only 8% and an expiry rate of 11% along with permanent disability in 3 patients was noted. Significantly higher fatality rate was seen in subdural-hematomas.

Conclusion : Road traffic accident (RTA)-Associated neurotrauma is a pressing problem in young males and the high disability and injury rate can be accounted to non-compliance with helmet-use and ignorance of road-safety. Worse outcome is associated with subdural-haematomas (SDH), first-riders, referred-cases and rural residence. Effective legislation and collective community effort is needed to counter the dilemma.

Key Words : Traumatic Brain Injury, Motor Vehicle Crash, Helmets

Introduction

Motorbikes in recent years have become an increasingly prevalent mode of transport in Pakistan and despite causing a significant level of injuries and fatalities, they remain relatively under-represented in national medical literature. The resultant traumatic-brain-injury (TBI) costs and debilitating long-term

effects in view of the affected cohort in a third world country makes this of vital interest. Traumatic-brain-injuries, the silent epidemic, have increasingly become a source of global morbidity and mortality. It is predicted by WHO that they will be the third leading cause of death and disability world-over by 2020. ¹As per 2015 they are the tenth most common cause of death in low-and-middle-income countries.(LMICs) Nationally, RTAs are fifth leading cause of loss of healthy life and second leading cause of disability.^{2,3}Of the many mechanisms responsible, motor vehicle accidents, particularly motorbike accidents have become a well-recognized local vector of TBI. Their proliferation has increased tremendously in Pakistan.⁴ The lower cost and easy accessibility makes them a very convenient choice in LMICs. TBIs are documented to occur 26 times more commonly per-mile in these travelers as opposed to those occupying a passenger car.⁵ In Pakistan these are notably prevalent rendering them especially a menace. Jinnah Post-Graduate Medical Centre Karachi caters 150 people every day for motorbike-related injuries. Of the 30,274 injuries reported in 2014, 25,855 were motorcycle related. Of them, 565 people suffered fatalities.⁶ Further reinforcing, as per Pakistan first road-traffic-injury surveillance report, Commonest road user to be affected was rider of two wheelers. (45%).⁷

The resultant injuries in most of these cases are debilitating and with long-lasting effects.⁸ Apart from the physical and mental strain that riddles the affected family, another crippling aspect of the matter is the associated-cost.⁹ These continue to pose a challenge to both the affected as well as the health infrastructure. Effective legislation and simple interventions such as protective head-gears has been deemed pivotal in impacting the outcome of these patients.⁵ In light of this, a vast and well-worth avenue is opened up for corrective intervention and prevention. This is further highlighted by the fact that previously helmet use rates of only 1-7% overall have been documented locally.⁷

Patients and Methods

This was a descriptive, prospective, cross-sectional study conducted at Neurosurgery-department of

DHQH-Rawalpindi. DHQ Hospital, Rawalpindi. It is a reference point for neurotrauma-injury in the province and patients from all over the city as well as far flung areas are received by it. This study was conducted from March to April 2018. All cases of motorcycle-accidents with neuro-traumatic injuries were included in the study. Both outdoor and indoor patients were accounted for and data was collected through a specifically-designed proforma. Variables noted included age, mode of presentation, gender, type of head-injury, associated injury, outcome, type of rider, socioeconomic status, helmet-use, education-level, residence, mode of treatment, duration of hospitalization and permanent-disability. Informed consent was obtained from the patients and in case of unconscious patients from the family members. All patients were treated for their respective injuries and complications and were managed as per standard departmental protocols. The data was evaluated through IBM-SPSS version 23. Continuous variables were described as mean \pm standard-deviation and were compared through T-test of independence and categorical variables were evaluated through chi square. P value less than 0.05 was considered significant.

Results

Majority (86%) were male. Mean age of patients was 28.89 ± 15.17 years. Majority age-group was 14-28 years (55%). Peak age was 18 years (n=8) and 61% of the patients were referral-cases and 39% primary-cases. Mean time-of-presentation of patients was 4.96 ± 9.23 hours. For referral cases this was 5.8 ± 10.9 hours and for primary cases this was 3.52 ± 5.9 hours. Mild head injury was seen in 63%, moderate in 23% and 14% had severe head injury. Presenting GCS had a statistically significant effect on outcome. (P-value 0.00), Mode of Management (p-value 0.02) and type of injury. (p-value 0.000) 91% of the expired patients had GCS ≤ 8 on presentation. 56% of the patients had singular type of neuro-trauma while 44% had multiple. Subarachnoid-hemorrhage (SAH) was the most common type of injury (Table 1). Associated injuries were present in 26% of cases. Bone fractures constituted 96% (Table 2). First-riders outnumbered second-riders (73%). Fifty one percent of 1st riders had multiple injuries as opposed to 35% of 2nd riders. Expiry rate was higher in 1st riders (n=10, 91%) as opposed to 2nd riders (n=1, 10%). First riders were exclusively male (p-value 0.00) and associated injuries were more common in them (n=23, 88%) as opposed to second riders (n=2, 7.6%). Expiry-rate was 11% and recovery-rate was 87% with 2% LAMA. Type of injury

had a statistically significant impact on outcome (p value 0.00). 63% (n=7) of the expired patients had multiple neurotraumatic injuries and only 27% (n=3) of these had associated injuries (Table 3).

Highest mortality-rate (80%) was of subdural hematoma (SDH). SAH had the highest recovery rate in both singular (95.6%, n=22) as well as multiple (100% n=17) injury cases. Followed by EDH that had recovery rate 90.9% in both singular (n=8) and multiple injury cases. Operative-rate was 12%. 75% (n=9) were 1st riders. 50% were urban-residents and 75% were males. 66.7% were referrals. 50% had multiple injuries. Most common trauma was EDH (n=8) followed by depressed-fracture (n=5) and SDH (n=2). 33.33% of operative patients expired.

Mean duration of hospitalization was 4.22 ± 3.41 days. Longest duration of hospitalization was for spinal injuries (8 ± 4 days) followed by SDH (6.6 ± 4.8) and Intracranial-Bleed (ICB) (5.25 ± 3 days). Shortest was for SAH and linear-fractures. Mode of treatment was significantly related to duration of hospitalization. Helmet-use-rate in our study was 8%, 75% (N=6) in males and 25% (N=2) in females. 83.3% (n=10) of the patients managed operatively were un-helmeted. Three of these patients had SAH, EDH in 2, depressed-fracture in 2 and linear-fracture in 1 patient.

Helmet wearing was not commonly observed in rural riders. Urban residents outnumbered rural (64%). Expiry rate in rural-residents was 13.9% as opposed to 9.4% in urban-residents. 55% of the patients belonged to lower-socioeconomic class and 24% and 20% were of lower middle and middle class respectively. Permanent disability was noted in 3% of the patients being blindness, ptosis and hemiplegia.

Table 1-Frequency of different types of Neurotrauma

Type of Neurotrauma	Frequency
SAH	40
EDH	25
Linear-Fracture	19
Contusions	18
Depressed-fracture	11
Base-of-skull fracture	9
Spinal-fracture	6
SDH	5
Pneumocephalus	5
ICB	4
Intra-ventricular-haemorrhage	1
Diffuse-Axonal-Injury	1

Table 2- Frequency of different types of Associated injuries

Associated Injuries	Frequencies
Upper-Limb Fractures	15
Lower-Limb Fractures	7
Cranio-facial	3
Pnuemo-haemothorax/Visceral	1
Thoracic Fractures	1

Table 3- Type of injury of expired patients

Neurotrauma	Number of Expiries
SAH*	1
EDH**	1
EDH + Base-of-skull Fracture	2
EDH + Depressed Fracture	1
Depressed Fracture	2
Linear Fracture+ Pneumocephalus	1
SDH	1
SDH + SAH	2
SDH + BOS fracture	1
ICB	1

*SDH=Sub Dural haematoma; **EDH=Extra Dural Haematoma

Discussion

RTAs are reported to cause 30-90% of trauma admissions in LMICs and 92% of the annual-traffic-fatalities occur in these countries.^{10,11} In line with this in Pakistan nearly 1/3 of all A&E visits are documented to be TRI-related and rates as high as 48-85% are reported. Most of these are a result of 2 wheeled-motorized-vehicles^{6,7,10-14}. In LMICs motorcycles account for less than half of the registered vehicles but comprise more than half of the road-fatalities and as per 2009, Pakistan was the 8th biggest market of 2 and 3-wheeled vehicles in Asia.^{15,16} In this context we included only motorcycle-related RTAs as a relative increase in their number and disproportionate literary representation coupled with their higher fatality via miles-per-vehicle travelled makes them a pertinent cohort in our locality.⁵ In this study male predominance is noted. This has been reflected in previous national studies .^{13, 17, 14, 18} International studies reflected same pattern .¹⁹⁻²³ This can be attributed to preset gender-roles as well as the patriarchal setup of our country where females have restricted mobility.²⁴They also constituted none of the 1st riders. This also reaffirms that TBI is more common in males.²⁵

A recurrent younger age-distribution pattern can be observed world-over and similar age-disposition is noted in many other LMICs.^{9-22,25-28,13}.Economic-cost,

increased availability, lax and ineffective traffic legislation and easy accessibility are all culminating factors²⁹. In a third-world country like ours, buying a motorbike as opposed to a car is more convenient to a younger employed sector. Moreover unsafe tendencies such as lack of helmet , over-speeding, one-wheeling, increased impulsivity and violation of traffic laws also contribute to increased representation of this age group^{30,6}.Hence it further reiterates RTAs as a leading cause of death in children aged 14-19 yrs.³¹

In addition to driver-related causes urban-rural profile is also a pivotal point in incidence and outcome of RTAs, each carrying its own risk-factors. Over-speeding and ignorance of road-safety and bad-roads are a daunting challenge in rural setup.^{32-34,20} Increased congestion and ineffective legislation is contributory to the former. In this study, increased referrals were noted from rural set-ups. This highlights the previously documented problem of lack of definitive-care in rural areas. In consistency with this, higher expiry-rate as well as higher operative-rate in rural residents is noteworthy. In TBI the outcome is greatly time-dependent and prognosis is determined by immediate first-aid measures.²³ Hence higher mortality in transfer patients is a clinical implication and immediate access to medical services should be expedited.³⁵

Helmet use rate in US is 65.2%.³⁶ Our rate is significantly lower (p-value 0.00) but this mirrors the previous rates nation-wide which denotes no improvement.^{37, 17, 7, 12, 18} This low rate is further concurred as a LMIC phenomenon as similar rates are seen in numerous other countries such as China,India,Nigeria etc^{19-22,27,38,39}. It is noteworthy that 0% rate was observed in females and rural residents. Lower helmet-use-rate is credited to physical discomfort, reduced visibility, cost of the helmet and laxity of legislation. Previously concerns were raised about helmets increasing the chances of cervical-spine injury,this misconception has now been dismissed.⁴⁰ Helmets are 37% effective in preventing fatal injuries to motorcycle riders and 41% to 2nd riders.⁵ Un-helmeted riders also have longer hospitalization, greater-disability and economic-costs.^{5,41-43} In our study 60% of operated patients were un-helmeted. Awareness needs to be spread about the cost of the head-injury versus cost of the helmet. TBIs are among the most costly injuries and extend beyond the individual and his family to the community at large through potential economic losses and declining work-force. As in third-world countries like ours dependency ratio is very high, hence, the loss of a

male member affects the entire family unit.⁴⁴ In the US in 2015 around 19 billion USD were saved by the use of helmets.⁴⁵ Thus helmet use is imperative in ensuring quality of life in our set-up. Better legislation³⁶ strict implementation and awareness-programs focused especially on females, 2nd riders and young adults should be put into effect.

As opposed to 4-wheel-vehicles, the lesser protection and more exposure offered by the vehicular design of motorbikes³¹ leads to increase chances of bone-fractures, head-trauma and thoracic injuries.¹⁸ Orthopedic-injuries are most commonly associated with RTAs following head-trauma and this was also seen in our study.^{17,20, 38, 47} This entails the need for better extremity protection as the healing time and the physical restraint placed by the orthopedic injuries are particularly taxing. This urges attention from automobile industry in addition to medical community. First riders overall in our study had worse outcome in terms of multiple injuries, associated injuries and higher expiry-rate consolidating similar results have been noted.³⁸

TBI are a cornerstone of motorcycle-related fatality. Bleeds (SAH,EDH,SDH) at 50% outnumbered cranial-fractures at 20% in our study. It is to be noted that 19% had both injuries concurrently. This has previously been noted.^{47, 42} Contrary to these the most common bleed in our study was SAH followed by EDH (46%). Helmet-use had no significant impact on type of injury or outcome however both were noted in less frequency in helmet-wearers.SDH are reported to be more deadly and have a higher mortality-rate.^{19, 48,23} In present study recovery rate was lowest with SDH and highest with SAH. The higher impact required to produce a SDH along with more parenchymal toll has been merited for the negative outcome. The force resulting in SDH also causes concomitant severe injuries. EDH has been linked with a positive outcome as high as 100% if treated properly^{19,48,23}. We also noted a favorable outcome for EDH with recovery-rate of 92%.

Our operative-rate mirrored that of US being 11% exactly as well as that of other countries that is within the same range^{49,42,19} The duration of hospitalization of these patients was significantly increased and it was maximal in case of EDH and SDH.

The high mortality-rate of this mode of transport spans over both high-income-countries and LMICs.^{19,26,27,11,21,22} This rate for other vehicles has decreased it has contributed to motorcycles making up a bigger share.⁵⁰A number of factors including head-on collisions, pre-hospital care, delay in reaching

definitive-care, treatment protocols as well as governmental policies and expenditures on health sector can be held responsible and this rate calls for imminent interest to counteract the multi-tiered aspects associated with motorcycle-associated TBI-management and care. Helmet-safety standards in addition to use-rate also pose a questionable dilemma. As seen in our study with permanent disability noted in 3 patients of a young age group, the personal and economic burden of these injuries is undeniable.

Motorcycle-accident patients that were received dead on admission were not included in the study as no imaging was done. Lastly, the study was conducted in only one hospital, However cases from both Benazir-Bhutto-hospital and Holy-family-hospital (major tertiary level govt hospitals in the city) are referred to DHQ-Rawalpindi as it is a neurosurgical reference-point. Cases from all over Punjab, Kashmir and Northern-areas are also received here. This can lead to an assumption that results can be generalized .

Conclusion

- 1.Effective legislation and involvement at all levels is required to reduce the toll of Motorbike-associated TBI. Mandatory licensing and increasing helmet-use-rate need urgent attention especially among rural residents and females.
2. Higher expiry rates from bleeds and inefficient immediate care in these patients are also in need of due medical attention.

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