

Original Research Article

Patterns and characteristics of injuries encountered in road traffic accidents and effect of pre-hospital care on their outcome: a tertiary-hospital study in Lahore, Pakistan

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Received: 17 April 2019

Revised: 09 June 2019

Accepted: 11 June 2019

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ABSTRACT

Background: Road traffic accidents are the eighth leading cause of death worldwide, contributing significantly to the global disease burden. As there is a paucity of published data on RTAs in Lahore, this study was carried out to highlight injuries encountered in RTA victims and provide baseline data for the establishment of prevention strategies in our locality.

Methods: This is a descriptive cross-sectional study of RTA victims admitted in Mayo Hospital, Lahore to determine factors associated with RTAs, characteristics, and outcomes of injuries sustained and effect of Pre-hospital care in determining the outcome.

Results: Out of total 100 subjects recruited, 89 were males and 11 females. Ages of patients ranged from 5 to 70 years with the most injured age group ranging between 11-30 years (59%). Motorcyclists were found as the most vulnerable road user group (61%). Most of the accidents occurred because of a collision with another vehicle (45%). 65 victims received pre-hospital care en route to Mayo Hospital, which was found effective in preventing major disabilities in 81% of cases (53 out of 65). Incidence of Musculoskeletal injuries was highest (55%). Most patients (86%) were discharged without permanent disabilities. No patient died during our study.

Conclusions: This study shows road traffic accident is a major public health problem in our setting and contribute markedly to high morbidity. Urgent preventive measures should be established to reduce the risk of their occurrence. Early recognition and prompt treatment are important for the survival of the victims.

Keywords: Road traffic accidents, Injuries, Pre-hospital care, Outcomes, Lahore

INTRODUCTION

Road traffic accidents (RTAs) are one of the terrifying realities of life. Risk is associated with any form of transportation.¹ According to the latest World Health Organization (WHO) report, around 1.25 million people died from road traffic injuries in 2013, and another 20-50 million people sustained non-fatal injuries as a result of road traffic collisions or crashes.² Accidents are a major cause for killing young men aged 15-29 and the second

biggest cause of disabilities and illness among adolescents.³ The United Nations (UN) General Assembly has declared the 2011-20 as the Decade for Road Safety with a goal to bring the number of global deaths and injuries from RTAs decreased to half by 2020 (Target 3.6: sustained development goals).^{4,5}

There is a pronounced difference in fatality rates because of RTAs among low and high-income countries. According to a study on global burden of injuries, more

than 85% deaths and 90% of disability-adjusted life year (DALY) lost globally occur in low and middle-income countries.⁶ The level of immediate post-crash care received as well as later care in a health-care facility are also directly related to the income level of countries.²

In Pakistan, many road traffic crashes and collisions are observed every day. Haider and Ghaffar, in a systematic review of the literature on motor vehicle accidents in Pakistan reviewed public sector records from the police, which indicated a continual rise in the number of motor vehicle crashes, injuries, and fatalities in the country since 1956.⁸ They also noticed that commercial and public service vehicles are more involved in reported motor vehicle crashes in Pakistan.⁸ According to Pakistan Bureau of Statistics data, 60% of people died per accident in Punjab, being the second highest ratio in country.¹⁰ Durrani, referring to the same Pakistan Bureau of Statistics data, reported in *The News* (August 23, 2015) that “Traffic accidents kill an average of 15 people in Pakistan daily”.⁹

Rescue 1122, in Consolidated Report of Emergency Calls and Rescue Operations in Punjab (2004-2017), presented that there were total 379957 road accident reported in Lahore.¹² The report also reveals that the Rescue 1122 responded to 3,429 Road Traffic Accidents in one month in Lahore (September 2015 to October 2015), which included total 3602 victims and 30 death. Shaikh conducted a research on road rage and road traffic accidents among commercial vehicle drivers in Lahore, and pointed that road rage, being a serious risk factor, is found very high in commercial drivers in Lahore.¹¹ Moreover, he reported that drivers are found more vulnerable than passengers in a Road Traffic Accident.

According to a controlled study of road traffic casualties in Iraq, prehospital care was a significant contributor to survival.¹³ However, very few studies have been conducted in our setting about RTA outcomes and importance of post-crash or Pre-Hospital care in preventing disabilities and fatalities. Therefore, this research will focus on preventable injuries, their characteristics and associated factors, encountered by RTA victims admitted to Mayo Hospital, Lahore. It will help medical professionals to reduce RTA related fatalities and disabilities, and will also enable policymakers to develop better strategies to minimize human loss and preventable injuries by improving road safety. It may also increase general awareness about pre-hospital care.

METHODS

This research was conducted in Accident and Emergency (A & E) Department of Mayo Hospital, Lahore, Pakistan. This research followed a descriptive cross-sectional design, and we pursued all patients admitted in Surgery and Orthopedic departments for one month (July 2017-August 2017) until they were discharged or expired.

A consent form was presented to all RTA victims irrespective of age, gender and severity or type of injuries attending the A & E Department of the Mayo Hospital during the study time. In the case of minors or unconscious patients, accompanying relative or caretaker were asked to consent. Those who were unconscious or in any way not able to consent and had no accompanying relative or caretaker to permit to the study were excluded. Total 108 road traffic accident (RTA) victims attended Accident and Emergency Department of Mayo Hospital during study duration out of which 100 fulfilled inclusion criteria and were enrolled in the study.

The purpose of this research was to investigate the characteristics of injuries and the effect of pre-hospital care on their outcome in RTA victims. We modified a pre-designed questionnaire¹⁴ to collect data from the RTA victims. A scale of ten questions was added at the end to assess the beliefs of RTA victims about the accidents and their responsibility.

In addition, we used Glasgow Coma Scale (GCS) to assess the condition of the patients with head injuries and Kampala Trauma Scale KTS II was used for detecting the severity of injuries. We asked questions from RTA victims regarding their biodata, site, time and date of the accident, type of road user, speed of the vehicle, use of helmets and seat belts and whether pre-hospital care was given or not. We also interviewed the attending doctor about the type of injuries, treatment plan and state of the patient. We followed up these RTA victims in the Mayo hospital Surgical and Orthopedic departments for their recovery status and condition at the time of discharge.

Statistical data analysis was done using SPSS software version 23.0. Descriptive statistics were used, and data were summarized in the form of proportions and frequency tables for categorical variables. Chi-square was used to determine the effect of pre-hospital care on final outcomes. Important findings were highlighted in the form figures and charts.

RESULTS

In this section, we present our findings in the following eight sub-sections. We covered socio-demographic profiles of the RTA victims, details about the RTAs encountered by these victims, characteristics of their injuries, treatments provided and outcomes of these injuries, the effect of prehospital care on the outcomes, and environmental factors associated with RTAs. General perspective of patients regarding Road Traffic Accidents was also asked and reviewed.

Socio-demographic profile of the subjects

Out of 100 subjects, 89 were males and 11 females, with male to female ratio of about 8:1. Patients ages ranged from 5 years to 70 years. The modal age group was between 10-20 years with 32 patients, second being 21-

30 with 27 patients, showing a majority of RTA victims being teenagers and young adults. The single RTA victims (65%) were injured more as compared to the ones who were married (44%). Regarding the educational level of RTA victims, 23% of RTA victims were illiterate,

17% knew only basic reading and writing, 43% had attended formal school out of which 20% and 23% had a primary and secondary school education respectively while 17% had reported a higher level of education (Table 1).

Table 1: Demographic profile of RTA victims.

Number of participants		Frequency	Percentage (%)
Age	100	below 10	4
		10-20	32
		21-30	27
		31-40	18
		41-50	10
		51-60	6
		61-70	3
Gender	100	Male	89
		Female	11
Educational Level	100	Illiterate	23
		can read and write	17
		primary school	20
		secondary school	23
		college/ high school	8
		university	9

Information about the accident

Most of the study subjects (77%) met the accident on main roads, contrary to 23% of accidents which occurred in residential areas (town/colony). Only 6 out of 100 RTAs caused mortality at the site of incidence. Out of 100 subjects, 61 were motorcyclist, 15 vehicle passengers, 14 pedestrians, nine were driving car or minibus, and only one was on cycle when they got injured in the accident (Figure 1). A clear majority of patients were injured due to collision (45%) with the vehicle, followed by a fall from a moving vehicle in 37% victims (Figure 2). Motorcycle is found to be the primary cause of RTA in 42% cases, car was the second important vehicle involved (22%), and other causes included heavy truck (13%), rickshaws (11%), buses and pick-up trucks (10%) (Figure 3).

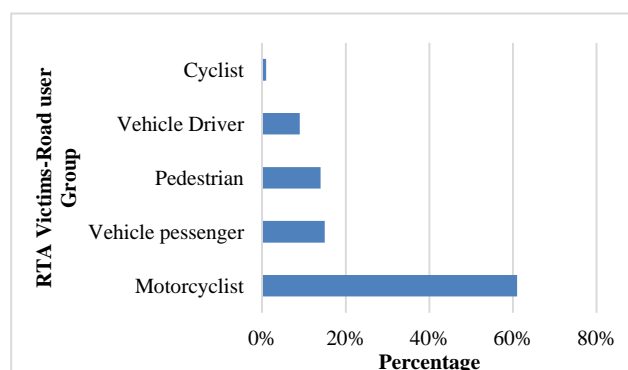


Figure 1: Road user group from which RTAs victim belong.

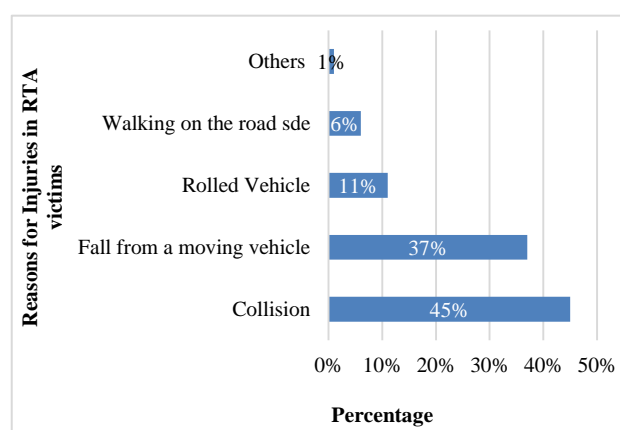


Figure 2: Reasons for Injuries in RTA victims.

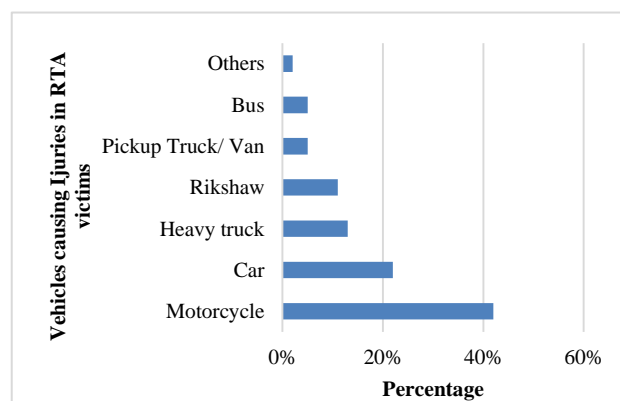


Figure 3: Vehicles causing injuries in RTAs.

Most of the accident happened during the evening to midnight, i.e. 6 PM-12 AM (39%), and 20% occurred after midnight (12-6 AM). On the contrary, 36% RTA occurred in afternoon i.e. between 12 noon and 6pm and only 5% were experienced from early morning to mid-day (6 AM-12).

Out of 100 RTA victims, 70 were brought to Mayo Hospital Lahore in 2 hours, with 23 of these within only 30 minutes. Others were admitted after one or more than a day after the accident, mostly being referred from other primary and secondary hospitals. Majority of patients (62%) were brought by ambulance while other means of transportation included private conveyance (12%), rickshaws (11%) and taxis (Table 2).

Table 2: Information regarding RTAs.

	Number of the participants		Frequency	Percentage (%)
How patient got injured in the accident?	100	Walking on the road side	6	6.
		Fall from a moving vehicle	37	37
		Rolled vehicle	11	11
		Collision	45	45
		Others	1	1
How long it took to bring the victim to Mayo hospital, Lahore?	100	less than 30 min	27	27
		30 min to 2 hours	43	43
		2 hours to 1 day	26	26
		more than 1 day	4	4
Where was pre-hospital care given to the victim?	100	At the scene	13	13
		In the hospital	23	23
		In the ambulance	29	29
		None	35	35

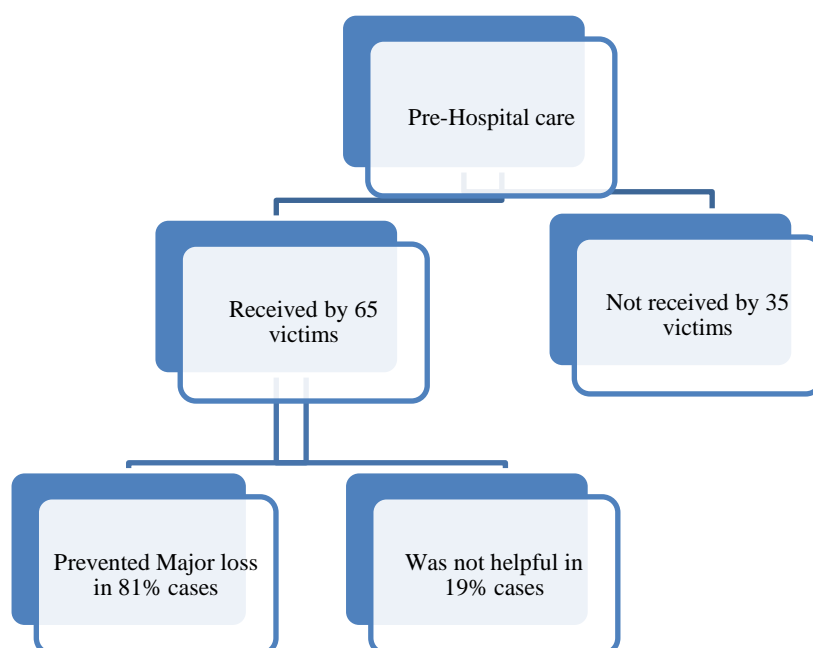


Figure 4: Effect of pre-hospital care on final outcome.

Table 3: Affect of pre-hospital care on final outcomes (cross tabulation).

Pre-hospital care/treatment given to the RTA victims	Final outcomes (n=100)		
	Discharged without permanent disability	Discharged with a permanent disability	Total
Yes	53	12	65
No	33	2	35

Pre-hospital care and its effect

Out of 100 RTA victims enrolled 65 received pre-hospital care. 29 RTA victims were treated in Ambulance, 23 in the nearby hospital (primary/basic health units) and 13 of them received first-aid at the scene (Table 2). Pre-hospital care was provided in the form of a bandage, fracture stabilization, and pain-killer tablets or injections. Patients who were referred from other health units also received blood transfusion or normal saline. Pre-hospital care was found to be useful in preventing major loss in 53 out of 65(81%) cases (Figure 4 and Table 3).

Characteristics of injuries

Musculoskeletal (extremities) was the most common region injured accounting for 55% injuries alone. 29% of patients had more than one region injured, mostly extremities and maxillofacial regions were injured together (Table 4). 66 RTA victims experienced at least one open wound. 77% of RTA victims were alert at the time of admission in Mayo Hospital, Lahore, 13% were responsive to verbal stimuli, and only 2% were unresponsive.

Table 4: Characteristics of injuries and hospital stay.

	Number of the participants		Frequency	Percentage (%)
Region(s) of the body injured	100	Head	2	2
		Maxillofacial	7	7
		Abdomen	2	2
		Pelvis	5	5
		Musculoskeletal(extremities)	55	55
Types of fractures patient suffered from	100	Skull/maxillofacial fractures	11	11
		Clavicle fractures	1	1
		Pelvic fractures	5	5
		Upper limb fractures	36	36
		Lower limb fractures	22	22
		None	16	16
		Maxillofacial and Musculoskeletal	4	4
		Clavicle and lower limb	1	1
		Upper and lower limbs	3	3
		Pelvis and lower limb	1	1
Length of Hospital stay	100	Within a day	21	21
		1-5 Days	12	12
		6-10 Days	28	28
		11-15 Days	18	18
		16-20 Days	11	11
		21-25 Days	2	2
		16-30 Days	3	3
		More than a month	5	5

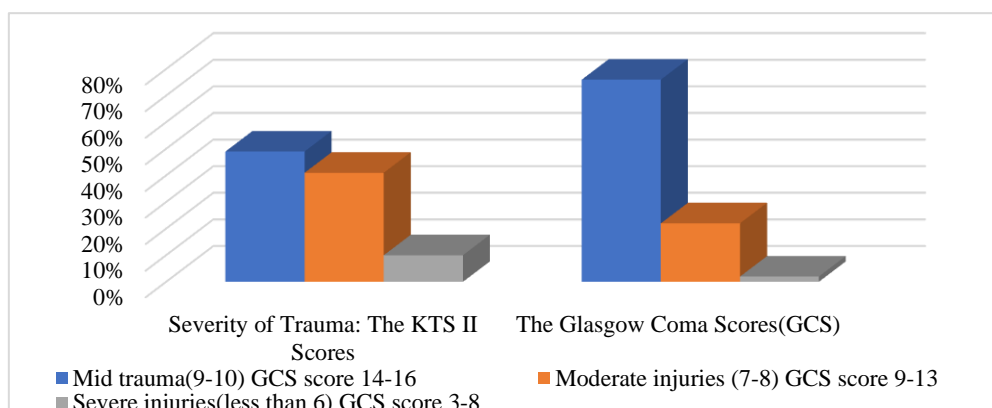


Figure 5: Severity of trauma in RTA victims (The KTS II Scores) and the glasgow comma scale (GCS) scores of RTA victims at the time of hospital admission.

Limbs were the most fractured bone region with upper limb fracture in 36 patients and lower limb in 22. Skull and maxillofacial/skull fracture were seen in 11 and five patients respectively. Multiple fractures including limb and another region e.g. maxillofacial were found in 8 RTA victims. Only 19 out of 100 RTA victims had no fracture (Table 4).

Intracranial Hemorrhages were found in a very small ratio in study subjects (only 3%). Only 10 RTA victims sustained visceral injuries, out of which 4 had an injury to the spleen. Chest injury was found in 5 patients, 3 had rib fracture, and pneumothorax and 2 sustained some mild compression injuries. According to Kampala Trauma Score II (KTS II), 49 patients had mild trauma (KTS II=9-10) while 41 victims had moderate injuries (KTS II=7-8) and severe injuries (KTS II \leq 6) were recorded in 10 patients (Figure 5). Glasgow coma scale (GCS) was used to assess neurological status at the time of admission in the hospital. Only 2% percent RTA victims had severe

brain damage with GCS lying between 3-8 and 22% showed moderate brain deficit with GCS ranging from 9-13. However, 76% had minimal or not at all brain involvement (GCS 14-15) (Figure 5).

Treatment and final outcomes

Out of 100 RTA victims, 70% of patients were treated surgically while 17% were treated both surgically and conservatively. Rest (23%) were managed conservatively with the help of medicines, sutures for lacerations and cleaning and dressing of the wound. 21 RTA victims sustained minor injuries and were discharged within a day (after 1-2 hours) after prompt treatment/dressing of wounds. Length of hospital stays varied among other 77 patients from 1 day to more than a month. The modal group was found to lie between 5-10 days (Table 4). Out of 100 RTA victims, 86 were discharged without any permanent disability. Other 14 underwent traumatic limb amputation (8%), post-traumatic seizures (2%) and permanent neurological deficits (1%) (Figure 6).

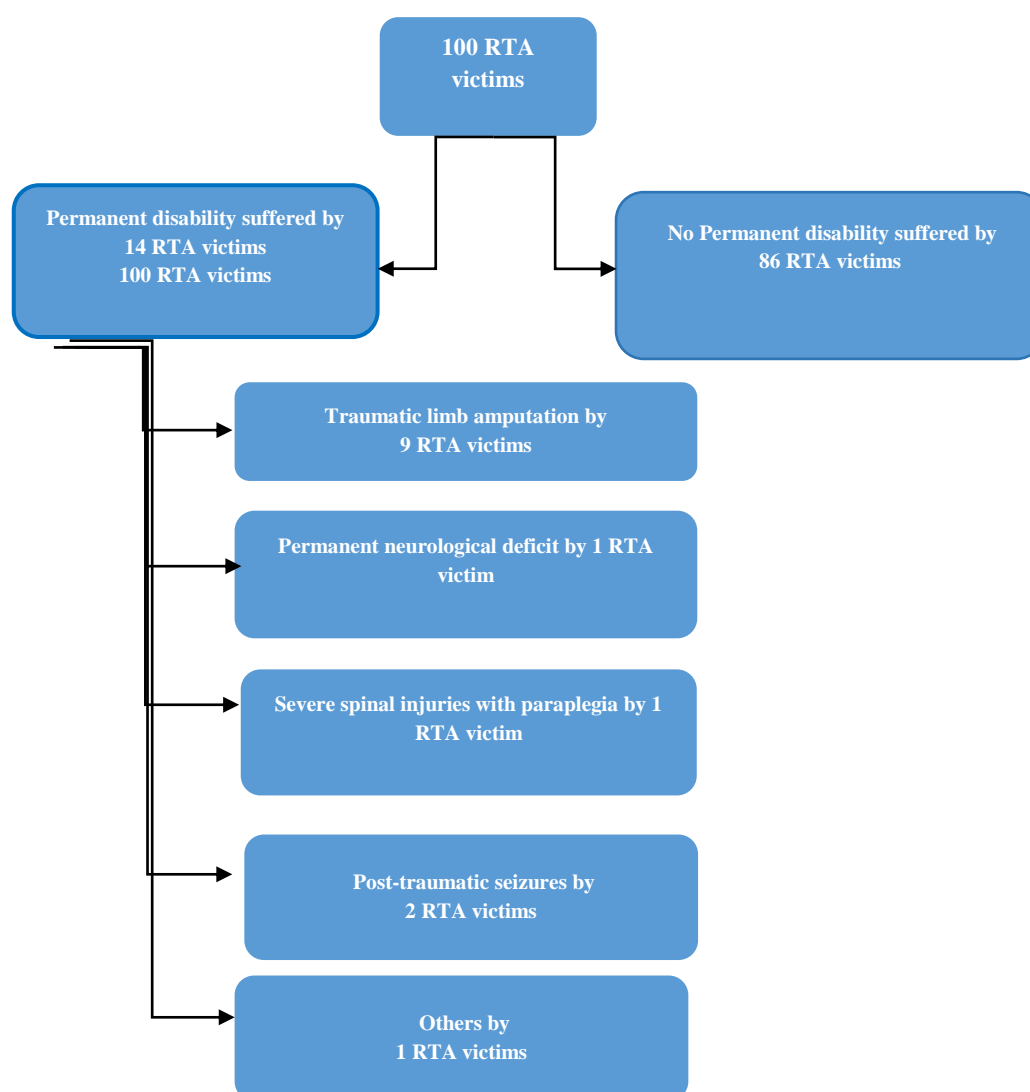


Figure 6: Permanent disabilities suffered by RTA victims.

Associated factors

Strikingly, helmet or seat belt use was only recorded in 11 out of 100 subjects. High speed was not found as a contributing factor in the majority of cases. The speed of most vehicles (71%) at the time of the accident was below 60 km/hr. Some accidents occurred because of the collision of a heavy vehicle with a parked vehicle (12%). Most of the accidents were experienced on a bright sunny day (46%) while only 34% at night. The rain was found to be an important cause of RTAs in 8% of cases. Road types showed great variance as a risk factor for RTAs. Broader Roads with more traffic burden were involved in 61% RTAs. Moreover, well-developed and developing areas also had a higher rate of RTAs, 40%, and 35% respectively.

General perspective of RTAs in sample population

During our study, a survey was completed to appreciate the general perspective of people regarding RTA in society, and interestingly it was found that out of 100 RTA victims 81 believed that road accidents are a curse or bad luck. Moreover, 44% of RTA victims strongly agreed to the fact that everyone who has a motorbike will have a road accident at least once in life. On the positive side, 77% of RTA victims believed most RTAs are preventable by adopting certain measures. 63% admitted that preventive measures like helmet/airbags could save from accidents. However, still, there were subjects who believed that no one could change their fate. The majority stated that the prevention of RTAs is the responsibility of law enforcement authorities, but still 31% were undecided in this regard. 84% of the sample population agreed on the point that the responsibility of RTAs lies on all road user groups. Most people were of the view that proper road safety measures are nonexistent in our cities. Almost 80% of the sample population acknowledged the fact that laws and rules need to be made and implicated for the safety of road users in order to reduce the risk of RTAs.

DISCUSSION

This study focused on Injuries encountered by RTA victims and their outcomes in victims admitted to Mayo Hospital, Lahore. Only a hundred patients were enrolled in this study during the one-month time frame. This study and its findings may be used as a window to prevue into a highly alarming situation of road traffic accidents in Lahore and its periphery. Male to female patients' ratio was found 8:1, similar to previous studies conducted in other regions of the World.^{14,15} This is because most of the RTAs are experienced by motorcyclists and female motorcycle drivers are not yet common in Pakistan. Most prevalent age group injured in our study was between 10-30 years. This is also in correspondence with other studies, as this is the most energetic yet inexperienced age group of the population.^{15,16} Several factors like rash/reckless driving, one-wheeling, bike races on main

roads are commonly observed in young people. They are largely indulged in dangerous activities than any other age group. It is the hour of need to make policies in this regard to prevent such a large burden on community and population.¹⁷

Motorcyclists were the most injured of the road-user groups in this study. This finding is also comparable to research conducted in other countries, e.g. Tanzania.^{15,17,18} The use of motorcycles in our country has strikingly increased in the last few decades as a motorcycle is a cheaper and faster means of transportation. However, this two-wheeled vehicle is unstable, and as use of helmet is also very minimal in motorcyclists in Pakistan, as evident from the results (only 11%), it increases the risk of RTAs and puts the rider's life at risk. However, recently there has been an advancement in this regard, making helmet use compulsory for all the motorcycle driver as well as passengers in Lahore.²¹

Musculoskeletal injuries are found prevalent in the sample population, with fractures as the most common injury encountered. Upper limbs fractures (44%) are more seen as compared to the lower limb. Other researches also show similar results in this regard, fractures, and musculoskeletal injuries being highest in RTA victims they studied.^{15,16} However, a study conducted in Karachi a few years ago, showed a higher incidence of head injuries in RTA victims, contrary to the pattern observed in our research.¹⁹

Most of the accidents occurred as a result of a collision with another vehicle. This is also consistent with the results of research conducted in Yemen.²⁰ This is due to haphazard driving seen in road users in haste to reach their destination as early as possible, neglecting many road rules. This is a preventable factor since laws can be made to control traffic and its flow, especially in developed countries.

Most accidents occurred from 6 PM to 12 AM. This is in accordance with the fact that most youngsters are found on roads during this time to relax and recreate after their school or college hours. Moreover, this is closing time for almost all workplaces and people are in a hurry to reach their homes after work. Moreover, tiredness and road rage can also be a cause of Road Traffic Accidents in our population. This was also deducted by a research conducted by Sheikh in Lahore.¹¹

Pre-hospital care is an important factor in determining the extent of damage and outcome of injuries experienced by RTA victims.¹⁷ In our study population, 65% of patients received pre-hospital care at some place (ambulance 44%, health care center 35%, and 20% at the scene) before their admission in Mayo Hospital Lahore. This shows a clear relation to the low frequency of permanent disability experienced (12 out of 65) while preventing major loss in 81% of the population (53 out of 65). Since

Mayo Hospital is a tertiary level Hospital, it receives many patients after being referred from other primary and secondary care hospitals. In our study results, 35% patients represent that part of the population who were referred from other health units after primary management including wound cleaning and dressing, fracture stabilization, pain management, and saline or blood transfusion.

About 25% of patients sustained only minor injuries which could have been managed at a basic health care facility. These only required conservative management like wound dressing, stitches and some pain-relieving medications. These are just draining human and medical resources in tertiary hospitals like Mayo Hospital. A Triage system should be introduced in this regard which would label the patients according to the severity of the injury as primary, secondary and tertiary. They should be then managed accordingly in respective health centers. This will improve treatment and care facilities for severe trauma patients at a higher level in a greater proportion. Moreover, there are no Emergency Trauma Centers in Lahore separately or within any hospital. Trauma centers and services should be introduced in hospitals to ensure better patient care.

The rescue and ambulance systems must be improved to provide more appropriate causality management at the spot and while on the way to the hospital, since time is a very crucial factor in trauma management. A study conducted in Tanzania to study RTA injuries and factors associated also emphasized on this fact.¹⁵ General population awareness and basic trauma management training should be ensured to prevent major human loss. This will improve first-hand management in case of an emergency or trauma, decreasing fatality and mortality in the population overall. Thus, most RTAs are preventable, and by adopting certain protective measures and by proper management of injuries sustained by victims, we can surely save many precious lives.

CONCLUSION

Road traffic accidents constitute a major public health problem in our setting and this research has provided important information about causes of RTAs and its associated factors. Most of them are preventable and policymakers should make and enforce proper laws to ensure road safety. Helmet use must be ensured in motorcycle users to prevent head injuries and traffic rules should be strictly followed. Pre-hospital care has proved to be an important factor in preventing fatalities. As a result, steps should be taken to provide this facility in every setting. Proper arrangements for providing pre-hospital care to the victims should be made through improved ambulance network and trained rescue workers. First aid education should be given in every institute. This will help in improving the quality of life in casualty victims. Minor injuries are being brought in tertiary care hospital. This should be organized by implication of

proper triage system, so that severely injured patients can be better treated and taken care. In this respect, Specialized Trauma centers should be established in hospitals and separately in different areas. Doctors and paramedics should be trained there to manage and treat trauma patients e.g. RTA patients. This will take healthcare delivery to a much higher level. In order to prevent citizens from such casualties, disabilities and fatalities, awareness and education regarding traffic rules and preventive measures should be given to the general population.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Payne-James J, Jones R, Karch SB. John Manlove 's Simpson's Forensic Medicine, 13th ed. Hodder Arnold; 2011.
2. World Health Organization. Global Status Report on Road Safety, 2017. Available at: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/. Accessed on 20 March 2017.
3. UNICEF East Asia & Pacific. The traffic accident crisis, 8 June 2015. Available from: <https://blogs.unicef.org/east-asia-pacific/the-traffic-accident-crisis/>. Accessed on 20 March 2017.
4. World Health Organization. World Health Statistics, 2017. Available at: https://www.who.int/gho/publications/world_health_statistics/en/. Accessed 20 March 2017.
5. WHO. Decade of Action for Road Safety 2011-2020 proclaimed by governments around the world, 2017. Available from: https://www.who.int/roadsafety/news/2010/unrsc_decade_of_action/en/. Accessed 20 March 2017.
6. Krug EG, Sharma GK, and Lozano R. The Global Burden of Injuries. *Am J Public Health*. 2000;90(4):523-6.
7. Hyder A, Peden M. Inequality and road-traffic injuries: Call for action. *The Lancet* 2003;362(9401):2034-5.
8. Hyder A, Abdul G, Tayyab M. Motor vehicle crashes in Pakistan: the emerging epidemic. *Injury Prevent*. 2000;6(3):199-202.
9. THE NEWS. Traffic accidents kill an average 15 people in Pakistan daily, 23 August 2015. Available from: <https://www.thenews.com.pk/print/58036-traffic-accidents-kill-an-average-15-people-in-pakistan-daily>. Accessed 20 March 2017.
10. Pakistan Bureau of Statistics. Available from: <http://www.pbs.gov.pk/>. Accessed 20 March 2017.
11. Shaikh MA, Shaikh IA, Siddiqui Z. Road rage and road traffic accidents among commercial vehicle drivers in Lahore, Pakistan. *Eastern Mediterranean Health J*. 2012;18(4):402-5.

12. Rescue 1122 Official Website. Available at: <http://www.rescue.gov.pk/performance.aspx>. Accessed 21 March 2017.
13. Murad MK, Issa DB, Mustafa FM, Hassan HO, Husum H. Prehospital trauma system reduces mortality in severe trauma: a controlled study of road traffic casualties in Iraq. *Prehospital and Disaster Medicine* 2012;27(1):36-41.
14. Seid M, Azazh A, Enquselassie F, Yisma E. Injury characteristics and outcome of road traffic accident among victims at Adult Emergency Department of Tikur Anbesa specialized hospital, Addis Ababa, Ethiopia: a prospective hospital-based study. *BMC Emergency Med*. 2015;15:10.
15. Respicious B, Lawrence M, Othman K, Victoria M. Factors associated with road traffic injuries in Tanzania. *Pan Afr Med J*. 2017;23:46.
16. Manish K, Anjana N, Sanjeev K. A study to assess the pattern and determinants of road traffic injuries during a year, a tertiary care hospital-based study. *Int J Res Med Sci*. 2016;4(7):2696-700.
17. Solagberu BA, Ofoegbu CK, Nasir AA, Ogundipe OK, Adekanye AO, Abdur-Rahman LO. Motorcycle injuries in a developing country and the vulnerability of riders, passengers, and pedestrians. *Injury Prevent*. 2006;12:266-8.
18. Phillip L, Joseph B, Ramesh M, Nkinda M, Isdori H, Alphonce B, et al. Injury characteristics and outcome of road traffic crash victims at Bugando Medical Centre in Northwestern Tanzania. *J Trauma Manag Outcomes*. 2012; 6:1.
19. Ahmed A, Raza M, Ahmed F, Ghani A, Siddiqui L. A Retrospective Analysis of the Pattern and Severity of Injuries in Victims of Road Traffic Accidents in Karachi, Pakistan during 2010-2011. *Emergency Med*. 2013;3:144.
20. Al-Thaifani A, Al-Rabeei N, Dallak A. Study of the Injured Persons and the Injury Pattern in Road Traffic Accident in Sana'a City, Yemen. *Advances in Public Health*. 2016;4138163:5.
21. Daily Times. Punjab police makes helmet usage compulsory by law, 12 September 2018. Available at: <https://dailytimes.com.pk/296610/punjab-police-makes-helmet-usage-compulsory-by-law/>. Accessed 10 April 2019.

Cite this article as: Ikram M, Fatima R, Ikram A, Shahid F, Rafiq M, Nisar T. Patterns and characteristics of injuries encountered in road traffic accidents and effect of pre-hospital care on their outcome: a tertiary-hospital study in Lahore, Pakistan. *Int J Community Med Public Health* 2019;6:2755-63.