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PATTERN AND DISTRIBUTION OF INJURIES IN FATAL ROAD TRAFFIC ACCIDENTS IN KARACHI

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Abstract

Abstract

urban centers like Karachi, where increasing vehicular traffic, poor infrastructure, and lack of enforcement contribute to a rising number of fatalities.

Objectives: *To determine the pattern and distribution of injuries in fatal road traffic accident victims brought for autopsy in Karachi.*

Study Design & Setting: *A descriptive cross-sectional study conducted at the Department of Forensic Medicine* Bilawal Medical College LUMHS Jamshoro from 19 December 2024 to 19 June 2025.

Methodology: *A total of 125 medicolegal autopsy cases of fatal RTAs were included through non-probability consecutive sampling. Data were collected using a structured proforma, including demographic information, road user category, and detailed autopsy findings. Statistical analysis was performed using SPSS version 25. Chi-square tests were applied to assess associations; $p < 0.05$ was considered statistically significant.*

Results: *Males comprised 73.6% (n = 92) of victims, with the 31–45-year age group most affected (33.6%). Motorcyclists (36.0%) and pedestrians (32.0%) were the most common road users. Head and neck injuries were observed in 81.6% of cases, while intracranial hemorrhage (69.6%) and skull fractures (60.0%) were the leading fatal internal injuries. The most frequent cause of death was isolated head injury (43.2%). A significant association was found between road user type and head and neck injuries ($p = 0.021$).*

Conclusion: *Head injuries and polytrauma were the predominant fatal injuries in RTAs, especially among motorcyclists and pedestrians, indicating the urgent need for improved road safety interventions.*

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INTRODUCTION

Road traffic accidents (RTAs) are a major public health concern worldwide, resulting in substantial morbidity, mortality, and socioeconomic burden.[1] According to the World Health Organization (WHO), road traffic injuries are the leading cause of death for individuals aged 5–29 years, with approximately 1.3 million fatalities and 20 to 50 million non-fatal injuries occurring annually.[2] The burden is particularly significant in low- and middle-income countries, which account for over 90% of global road traffic deaths, despite having only about

60% of the world's vehicles.[3] In Pakistan, the rising number of motor vehicles, combined with poor road infrastructure, lack of enforcement of traffic laws, andinadequate emergency response systems, contributes to an alarming increase in fatal RTAs.[4] Karachi, as the most populous city in Pakistan and a major economic hub, has witnessed a substantial rise in vehicular traffic in recent years. This increase has been paralleled by a surge in road accidents, many of which are fatal.[5] Contributing factors include reckless driving, road conditions, absence of pedestrian walkways, inadequate signage, and non-compliance with helmet and seatbelt laws.[6] Furthermore, the lack of systematic trauma care and delayed pre-hospital management play a critical role in worsening the outcomes of injured victims. Fatal road traffic accidents not only devastate families emotionally and financially but also pose significant public health challenges that require urgent and comprehensive strategies.[7] The injuries sustained in RTAs are often severe and involve multiple organ systems, most commonly affecting the head, chest, and limbs.[8] Sympathetic the pattern and distribution of injuries in fatal RTAs is essential for developing effective injury prevention strategies, improving trauma care systems, and guiding urban planning and policy reforms.[9,10]

In Pakistan, there is a relative paucity of published data addressing the specific injury patterns in fatal RTAs, especially in urban centers like Karachi. Most hospital-based records focus on survivors of accidents, while fatal cases—especially those declared dead on arrival—are often underreported or incompletely documented. This lack of comprehensive data limits the ability to implement targeted interventions for injury prevention and trauma management. This study aims to analyze the pattern and distribution of injuries in fatal road traffic accidents in Karachi through postmortem examination findings. By identifying the most frequently injured body regions and types of trauma, the study seeks to enhance the understanding of injury mechanisms in fatal RTAs. The results will be instrumental for health professionals, policymakers, and urban planners to adopt evidence-based strategies to reduce road traffic mortality.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at the Department of Forensic Medicine Bilawal Medical College LUMHS Jamshoro from 19 December 2024 to 19 June 2025 following approval from the Institutional Review Board. A total of 125 cases of fatal road traffic accidents were included in the study. The sample size was calculated using OpenEpi software, considering a 95% confidence level, 5% margin of error, and an expected frequency of 50% for different injury patterns, yielding a sample of 125 cases. All individuals who were brought dead to the medicolegal section due to road traffic accidents and underwent a complete medico-legal autopsy were included. Cases where death occurred due to other causes such as homicide, suicide, poisoning, drowning, burns, electrocution, or where the postmortem examination was not performed were excluded from the study. Convenience sampling technique was used.

Data were collected using a structured proforma, which included demographic details such as age, gender, and type of road user (pedestrian, motorcyclist, passenger, or driver), as well as detailed autopsy findings related to the pattern and distribution of injuries. Injuries were categorized by anatomical region—head and neck, thorax, abdomen, pelvis, upper limbs, and lower limbs—and by type, such as contusions, abrasions, lacerations, fractures, or internal organ damage. The probable cause of death as noted in the autopsy report was also recorded.

All autopsies were conducted by qualified forensic pathologists using standard protocols. External and internal examinations were performed to document visible and hidden injuries respectively. Radiological investigations (where available) and histopathological analysis (when required) were also considered to support the diagnosis. Particular attention was paid to determining whether the injury was fatal in isolation or in combination with other injuries.

Data were entered and analyzed using SPSS version 25.0. Descriptive statistics were used to summarize demographic information and injury patterns. Frequencies and percentages were calculated for categorical variables such as gender, type of road user, and types of injuries. Cross-tabulations were used to explore the association between injury distribution and demographic variables. The findings were presented in tables and graphs where appropriate.

RESULTS

Table 1 shows that the most affected age group in fatal RTAs was 31–45 years (42, 33.6%), followed by 19–30 years (38, 30.4%), 46–60 years (20, 16.0%), 0–18 years (15, 12.0%), and >60 years (10, 8.0%). Males were predominantly involved (92, 73.6%) compared to females (33, 26.4%). Among road user categories, motorcyclists accounted for the highest number of fatalities (45, 36.0%), followed by pedestrians (40, 32.0%), passengers (28, 22.4%), and drivers (12, 9.6%). Table 2 shows that the most common external injury among fatal RTA victims was abrasions (110, 88.0%), followed by contusions (96, 76.8%), lacerations (89, 71.2%), visible fractures (67, 53.6%), and amputations (7, 5.6%). As per Table 3, the most frequently affected body region was the head and neck (102, 81.6%), followed by the thorax (75, 60.0%), lower limbs (65, 52.0%), abdomen (58, 46.4%), upper limbs (47, 37.6%), pelvis (28, 22.4%), and spinal injuries (20, 16.0%). Table 4 indicates that intracranial hemorrhage was the most common fatal internal injury (87, 69.6%), followed by skull fractures (75, 60.0%), rib fractures with lung injury (48, 38.4%), multiple organ injuries (42, 33.6%), liver lacerations (30, 24.0%), spleen rupture (18, 14.4%), and cardiac injury (10, 8.0%).

Table 5 presents the probable causes of death based on autopsy findings. The most frequent cause was isolated head injury (54, 43.2%), followed by polytrauma involving multiple injuries (40, 32.0%), chest trauma (15, 12.0%), isolated abdominal injury (7, 5.6%), spinal cord injury (5, 4.0%), and hemorrhagic shock due to limb injury (4, 3.2%). Table 6 shows the association between type of road user and body region of injury. Head and neck injuries were most common in pedestrians (35, 87.5%) and motorcyclists (39, 86.7%) compared to passengers (21, 75.0%) and drivers (7, 58.3%), with a statistically significant difference ($p = 0.021$). No significant associations were found between road user type and injuries to the thorax ($p = 0.312$), abdomen ($p = 0.901$), pelvis ($p = 0.681$), upper limbs ($p = 0.208$), lower limbs ($p = 0.622$), or spine ($p = 0.171$).

Table 1: Demographic Distribution of Fatal RTA Victims (n = 125)

Variables	Category	n (%)
Age Group (years)	0–18	15 (12.0%)
	19–30	38 (30.4%)
	31–45	42 (33.6%)

	46–60	20 (16.0%)
	>60	10 (8.0%)
Gender	Male	92 (73.6%)
	Female	33 (26.4%)
Type of Road User	Pedestrian	40 (32.0%)
	Motorcyclist	45 (36.0%)
	Passenger (car/bus)	28 (22.4%)
	Driver (car/bus/truck)	12 (9.6%)

Table 2: External Injuries Noted During Autopsy (n = 125)

Type of Injury	n (%)
Abrasions	110 (88.0%)
Contusions	96 (76.8%)
Lacerations	89 (71.2%)
Fractures (visible)	67 (53.6%)
Amputations	7 (5.6%)

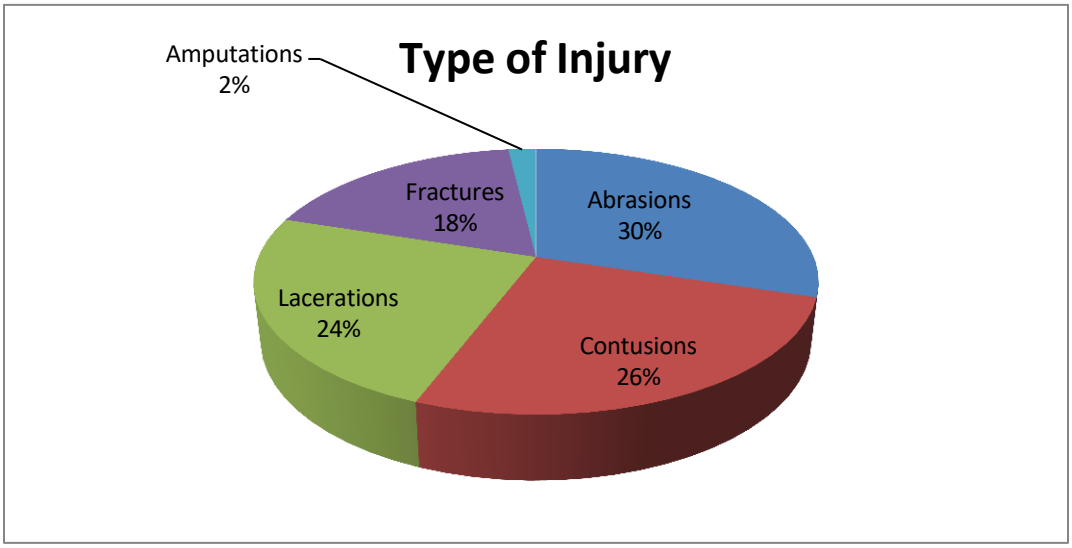

Table 3: Distribution of Injuries by Body Region (n = 125)

Body Region	n (%)
Head and Neck	102 (81.6%)
Thorax	75 (60.0%)
Abdomen	58 (46.4%)
Pelvis	28 (22.4%)
Upper Limbs	47 (37.6%)
Lower Limbs	65 (52.0%)
Spinal Injuries	20 (16.0%)

Table 4: Types of Fatal Internal Injuries Identified (n = 125)

Internal Injury Type	n (%)
Intracranial Hemorrhage	87 (69.6%)
Skull Fracture	75 (60.0%)
Rib Fractures with Lung Injury	48 (38.4%)
Liver Laceration	30 (24.0%)
Spleen Rupture	18 (14.4%)
Cardiac Injury	10 (8.0%)
Multiple Organ Injuries	42 (33.6%)

Table 5: Probable Cause of Death Based on Autopsy Findings (n = 125)

Cause of Death	n (%)
Head Injury (isolated)	54 (43.2%)
Polytrauma (multiple injuries)	40 (32.0%)
Chest Trauma (isolated)	15 (12.0%)
Abdominal Injury (isolated)	7 (5.6%)
Spinal Cord Injury	5 (4.0%)
Hemorrhagic Shock (due to limb injury)	4 (3.2%)

Table 6: Association Between Type of Road User and Region of Injury (n = 125)

Region of Injury	Pedestrian (n = 40)	Motorcyclist (n = 45)	Passenger (n = 28)	Driver (n = 12)	*p-value*
Head and Neck	35 (87.5%)	39 (86.7%)	21 (75.0%)	7 (58.3%)	0.021*
Thorax	20 (50.0%)	32 (71.1%)	15 (53.6%)	8 (66.7%)	0.312
Abdomen	18 (45.0%)	23 (51.1%)	12 (42.9%)	5 (41.7%)	0.901
Pelvis	10 (25.0%)	8 (17.8%)	6 (21.4%)	4 (33.3%)	0.681
Upper Limbs	12 (30.0%)	21 (46.7%)	8 (28.6%)	6 (50.0%)	0.208
Lower Limbs	22 (55.0%)	20 (44.4%)	15 (53.6%)	8 (66.7%)	0.622
Spinal Injuries	4 (10.0%)	7 (15.6%)	5 (17.9%)	4 (33.3%)	0.171

*p-value derived using Chi-square test, *Significant at $p < 0.05$

DISCUSSION

Road traffic accidents (RTAs) are a major public health issue globally, especially in low- and middle-income countries like Pakistan. Karachi, being the most populous city, reports a high incidence of fatal RTAs due to increasing traffic volume, poor infrastructure, and weak law enforcement.[11] Fatal injuries in RTAs often involve head trauma, internal organ damage, and multiple fractures.[12] Understanding the pattern and distribution of these injuries can help guide preventive strategies. Postmortem examinations offer reliable insights into the nature of fatal injuries. This study aims to evaluate the demographic profile and injury distribution among fatal RTA victims in Karachi.

The present study highlights that young adult males were most commonly affected in fatal RTAs, with 73.6% of victims being male and the 31–45-year age group constituting the highest proportion (33.6%). These findings are consistent with Khurshid et al. (2021),[14] who reported 54.5% of fatalities in the 18–40-year age group and a male-to-female ratio of 6.03:1, as well as Ahmer et al. (2019),[17] where 91.9% of victims were male and 64.4% were aged 15–35 years. Similarly, Muhammad et al. (2022) observed that 86.6% of road traffic injury (RTI) victims were males and 43.1% belonged to the 18–29 age group.[21] In our study, motorcyclists (36.0%) and pedestrians (32.0%) were the most common road users involved in fatal incidents. This aligns with Raza et al. (2013), who reported that pedestrians formed 31.1% of cases and were mainly hit by cars (38.9%).[15] Khokhar et al. (2020) also noted a high proportion of pedestrian victims (57%), followed by two-wheelers (24%).[19]

Similarly, Raja et al. (2023) found that 68.3% of victims were motorcyclists and 16.6% were pedestrians.[16]

In terms of injury pattern, head and neck injuries were most prevalent in our study (81.6%), followed by thoracic (60.0%) and lower limb injuries (52.0%). This strongly correlates with Raza et al., who identified head injuries in 59.4% of cases ($p < 0.001$),[15] and Khurshid et al., who found head injuries responsible for death in 64.6% and skull fractures in 53%.[14] In contrast, Shamim et al. (2017) reported a higher frequency of lower limb injuries (44.7%) and comparatively fewer head and neck injuries (27.8%), indicating a predominance of non-fatal trauma in their cohort.[13] Raja et al. also reported head and neck injuries in 33.3% of highway accidents and 40.0% in city limits, with lower limb injuries being second most common.[16] However, in Muhammad et al., lower limbs (64%) were the most frequent site, followed by upper limbs (37.6%) and head injuries (32.2%).[21]

Regarding fatal internal injuries, our study found intracranial hemorrhage (69.6%) and skull fractures (60.0%) to be the leading causes, followed by rib fractures with lung injury (38.4%) and multiple organ injuries (33.6%). These findings are in line with Khurshid et al., who reported head injury as the cause of death in 64.6% and multiple traumatic injuries in 26.4%, with chest, abdomen, and pelvic injuries contributing 4.5%, 3.7%, and 0.8%, respectively.[14] Similarly, Khokhar et al. reported head injury in 69%, chest trauma in 17%, and abdominal and pelvic injuries in 10% and 3%, respectively.[19]

Our study also observed a statistically significant association between road user type and head and neck injuries ($p = 0.021$). This supports Zia et al. (2019), who found a significant relationship ($p \leq 0.05$) between mode of transport and injury severity.[18] While Hayat et al. (2019) focused on emergency medical services and reported a relatively low mortality rate (0.83%), our autopsy-based study provides a focused evaluation of fatal outcomes.[20] Our findings reinforce previous evidence that head injuries remain the predominant cause of death in RTAs, with motorcyclists and pedestrians being the most vulnerable. Differences in injury site prevalence between studies may reflect variations in study settings, fatality inclusion criteria, and emergency response systems.

A key strength of the study is the use of complete autopsy data, which provides accurate and objective injury documentation. The sample size of 125 cases enhances the validity of findings. Inclusion of different road user types offers a comprehensive overview of injury patterns. However, limitations include reliance on data from a

single city, which may limit generalizability. The study excludes non-fatal injuries and pre-hospital deaths not brought for autopsy. Additionally, missing pre-accident clinical information may have limited certain contextual interpretations.

CONCLUSION

Head injuries and polytrauma were the most common causes of death in fatal RTAs in Karachi. Motorcyclists and pedestrians were the most vulnerable groups. Targeted interventions and improved road safety measures are urgently needed to reduce fatality rates.

REFERENCES

1. Haghighi MR, Sayari M, Ghahramani S, Lankarani KB. Social, economic, and legislative factors and global road traffic fatalities. BMC public health. 2020 Sep 17;20(1):1413.
2. World Health Organization. Global status report on road safety 2023. Geneva: World Health Organization; 2023. Available from: https://www.who.int/teams/social-determinants-of-health/safety-and-
    a. mobility/global-status-report-on-road-safety-2023
3. Bhalla K, Mohan D, O'Neill B. How much would low-and middle-income countries benefit from addressing the key risk factors of road traffic injuries?. International journal of injury control and safety promotion. 2020 Jan 2;27(1):83-90.
4. Irfan H. Road safety in Pakistan: vulnerable road users, challenges and policy implications. Pakistan Journal of Humanities and Social Sciences. 2024 Dec 24:3415-26.
5. Azhar N, Khan RA, Arif F. Challenges to sustainable city development for Karachi-Pakistan. Construction Technologies and Architecture. 2024 Aug 19;4:189-96.
6. Khan K, Zaidi SB, Ali A. Evaluating the nature of distractive driving factors towards road traffic accident. Civil Engineering Journal. 2020 Aug 1;6(8):1555-80.
7. Koome G, Atela M, Thuita F, Egondi T. Health system factors associated with post-trauma mortality at the care level in Africa: a scoping review. Trauma Surgery & Acute Care Open. 2020 Sep 30;5(1):874-79.
8. Kaya B, Balandiz H, Sanci A. Evaluation of road traffic accident-related deaths: An autopsy study. Ulus Travma Acil Cerrahi Derg. 2025 Jul 1;31(7):661-8.
9. Leijdesdorff HA, Gillissen S, Schipper IB, Krijnen P. Injury Pattern and Injury Severity of In-Hospital Deceased Road Traffic Accident Victims in The Netherlands: Dutch Road Traffic Accidents Fatalities. World journal of surgery. 2020 May;44(5):1470-7.
10. Omoke NI, Ekumankama FO. Incidence and pattern of extremity fractures seen in accident and emergency department of a Nigerian teaching hospital. Nigerian journal of surgery. 2020;26(1):28-34.
11. Razzak JA, Bhatti J, Wright K, Nyirenda M, Tahir MR, Hyder AA. Improvement in trauma care for road traffic injuries: an assessment of the effect on mortality in low-income and middle-income countries. The Lancet. 2022 Jul 23;400(10348):329-36.
12. Ali Q, Yaseen MR, Khan MT. The causality of road traffic fatalities with its determinants in upper middle income countries: a continent-wide comparison. Transportation research part A: policy and practice. 2019 Jan 1;119:301-12.
13. Shamim M. Pattern of injuries from road traffic accidents presented at a rural teaching institution of Karachi. Indian journal of surgery. 2017 Aug;79(4):332-7.
14. Khurshid A, Sohail A, Khurshid M, Shah MU, Jaffry
    a. AA. Analysis of road traffic accident fatalities in Karachi, Pakistan: an autopsy-based study. Cureus. 2021 Apr 13;13(4).
15. Raza MZ, Ahmed F, Ahmed A, Ghani A, Malik L, et al. (2013) Title of the Study: A Retrospective

Analysis of the Pattern and Severity of Injuries in Victims of Road Traffic Accidents in Karachi, Pakistan during 2010-2011. Emergency Med 3:144

16. Raja M, Natesan M, Kuthus NS, Sivakumar B, Vinisha K. A comparative study of the pattern of injuries occurring in patients caused due to road traffic accidents in city limits and highway limits. Int J Acad Med Pharm. 2023;5(4):1136-40.
17. Ahmer Z, Siddiqui A. Most Frequently Affected Body parts in Road Traffic Accidents Reporting to the Accident and Emergency Department of the Largest Tertiary Care hospital of Karachi in 2019. J Community Health Research 2021;10(3): 235-242
18. Zia AS, Awana MT, Omar N, Abid I, Liaquat A, Khan AA, Saleem A, Fatima A, Mian K. Epidemiological distribution of road traffic accidents in tertiary care setups of Lahore, Pakistan. Biomedica. 2018 Apr;34(2):103.
19. Khokhar A. Pattern of Road Traffic Accidents Mortality in Rawalpindi and Islamabad-An Autopsy Based Study. Pak J Med Health Sci. 2020;13(3):4-92.
20. Hayat N, Tabassum SR, Gillani YR, Bano N, Ahmed I, Saleem S. Characteristics of Road Traffic Accidents Causes, Injuries and Outcomes Encountered in Faisalabad Between 2016-2019. Journal of University Medical & Dental College. 2020 Dec 16;11(4):1-6.
21. Muhammad K, Shaikh S, Ashraf J, Hayat S. Characteristics, reasons and patterns of Road Traffic Injuries presenting in emergency department of a tertiary care public hospital in Karachi. Pakistan Journal of Medical Sciences. 2022 Mar;38(4Part-II):862.