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ORIGINAL ARTICLE

Decoding death on roads: A forensic evaluation of injury patterns and associated factors in road traffic accident fatalities in Peshawar.

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ABSTRACT… Objective: To assess the frequency, pattern of injuries and its associated contributory factors in road traffic accidents cases at Peshawar. **Study Design:** Descriptive Cross sectional study. **Setting:** Department of Forensic Medicine and Toxicology, Khyber Medical College, Peshawar. **Period:** 01st Jan 2024 to 31st Dec 2024. **Methods:** Included a total of188 candidates presented for autopsy at forensic medicine department, Khyber medical college from 01 jan 2024 to 31st Dec 2024.all cases with complete documentation and underwent RTA were included in study and cases with incomplete documentation were excluded from study. **Results:** The subjects' ages ranged from 2 to 80 years, with a mean of 36.9 ± 20.7. The majority of the people were from urban areas, from low-income families, and had no education. 96.8% of subjects had multiple injuries, compared to 3.2% who had only one. Overall, 188 cases resulted in 606 injuries, with 90.76% being little, 7.92% being medium, and 1.32% being large, including all types of injuries. The most common presenting injury was laceration (87.2%), followed by abrasion (59.6%), contusion (51.1%), fracture (23.4%), and haematoma (2.1%). The most common region involved in RTA was the head and neck, accounting for 86.17%. Maximal deaths occurred within 3-6 hours of an RTA. The most common cause of death was harm to the brain and its related arteries. **Conclusion:** The study hereby identifies that the prevalence of RTAs in Peshawar is alarming, mainly in young adult males, including both urban and lower socioeconomic backgrounds. The majority of victims suffered from multiple types of injuries. The head and neck were the most frequently implicated. Major cause of death was due to injury to brain and related arteries-a lethal consequence of head trauma. These findings go in accordance with national and international research, pointing to critical preventive initiatives addressing behavioural, infrastructure, and enforcement aspects.

Key words: Demographics, Forensic Medicine, Pattern of Injury, Road Traffic Accidents.

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INTRODUCTION

Road traffic accidents (RTAs) are still one of the top causes of morbidity and mortality worldwide, posing a significant public health and forensic problem. According to the World Health Organisation (WHO), over 1.19 million people die each year as a result of road traffic accidents (RTAs), with LMICs accounting for more than 90% of fatalities while having only about 60% of the world's automobiles.[1] RTAs are currently recognised as the eighth leading cause of death worldwide, and the top cause of death among those aged 5 to 29.[1,2] This global burden has substantial medical, economic, and social ramifications, especially in developing countries like Pakistan, where growing urbanisation, weak traffic regulation, and inadequate road safety awareness persist.[3]

It is much the same in Pakistan. According to data offered by the Pakistan Bureau of Statistics, more than 10,000 people are killed in road-traffic accidents, besides those seriously injured or disabled.[4] There are umpteen reasons for this exacerbated condition, varying from excessive speeding and reckless driving to improper care of transportation and indifference towards safety methods like helmet use in motorcycles and wearing seat belts.[5] Studies in Karachi, Lahore, and Rawalpindi have found youth in the age group 20-40 years, comprising mainly male subgroups, suffering disproportionately in accordance with their vulnerability in terms of high exposure rates in traffic and associated unsafe drivers' behavior.

Understanding the pattern and distribution of various injuries in RTA cases is of extreme importance for

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medico-legal investigation and for public health measures. Previous autopsy-based studies have demonstrated that head and neck injury represents the most common and fatal lesion in patients with RTA, often associated with cerebral haemorrhage and skull fractures.[9,10] High-velocity blunt trauma is also reported to cause lacerations, abrasions, and long bone fractures.[11] These similar trends are followed by developing countries such as India, Iran, and Tanzania, where head trauma is still the most common cause of death among road traffic casualties.[12-14]

Socioeconomic and educational attributes also contribute to road safety behavior. As suggested by the literature, low literacy and lower socioeconomic status are linked with higher accident rates due mostly to a lack of awareness about traffic laws and restricted access to safer vehicles or protection gear. In Pakistan, these problems are further compounded by poor road infrastructure, weak enforcement of law and order, and slow-moving emergency response systems.[3,7,17]

RATIONALE

Road traffic accidents prove to be prominent causes of morbidity and mortality rates in Pakistan, particularly in big cities like Peshawar because of high levels of urbanization and unplanned traffic management. An understanding of the forensic pattern of injuries resulting from RTAs is essential for arriving at conclusions regarding the circumstances of death and developing preventive strategies against RTAs. Though there has been an increase in RTAs, this region lacks proper forensic information. An in-depth analysis of RTA injury patterns and associated factors would definitely assist authorities in developing targeted preventive strategies against RTA-related mortality and improving road safety standards in Peshawar.

OBJECTIVE

To assess the frequency, pattern of injuries and its associated contributory factors in road traffic accidents cases at Peshawar.

METHODS

This Cross-Sectional study was conducted at Department of Forensic Medicine, Khyber Medical College, Peshawar from 01st Jan 2024 to 31st Dec 2024.

Census/Sample Size

All cases reported at the department in the said study duration.

Inclusion Criteria

1. All individuals engaged in road traffic accidents in the Peshawar district during the study period.
2. Cases with detailed medical, clinical, or police records can accurately identify injury patterns and contributing variables.
3. The study includes victims of all ages and genders with available and ethically approved data or autopsy findings.

Exclusion Criteria

- Records lacking essential documentation to determine injury pattern or contributory factors (e.g., missing medicolegal report, unreadable/ absent hospital records, no scene/police data).
- Cases with severe decomposition or mutilation where injury pattern cannot be interpreted reliably (forensic exclusion by pathologist).
- Duplicate records or repeat presentations of the same incident (only the first presentation will be included).
- Cases where a pre-existing terminal medical condition is judged to be the primary cause of death and the traumatic injuries are incidental/ minor (as determined by the attending clinician/ forensic pathologist).

Data Collection Procedure

Data was collected retrospectively from medico-legal autopsy reports, hospital emergency records, and police accident files of road traffic accident cases in Peshawar. A structured proforma was used to record demographic details, type of vehicle involved, nature and distribution of injuries, and identified contributory factors such as speeding, intoxication, or lack of safety measures. Relevant radiological and clinical findings were reviewed where available. All data was de-identified, coded, and entered into a secure database for analysis, ensuring confidentiality and ethical compliance throughout the process. Ethical approval was obtained from IREB Khyber medical College

Peshawar letter number 1071/DME/KMC.

Data Analysis Procedure

The data was processed using the SPSS analysis software after being cleaned and validated. The descriptive statistics analysis was used in describing the demography, the frequency of the occurrence of injuries, and the trends. The chi-square analysis was used in testing the link which might exist between the trends in the occurrence of injuries and the contributory factors such as age, gender, and vehicles. The results were derived using the mean, percentage, and standard deviation. The results were displayed in the format of tables and graphics.

RESULTS

The study covered 188 cases, with 93.6% (176/188) being male and 6.4% (12/188) being female. Furthermore, 160 individuals (85.10%) were from urban areas, while 28 (14.89%) were from rural areas.

The subjects' ages ranged from 2 to 80 years, with a mean of 36.9 ± 20.7. Table-I shows the group-wise distribution.

In total, 188 road traffic accidents occurred, with 3.2% (6/188) sustaining a single injury and 96.8% (182/188) suffering multiple injuries. Table-II displays the frequency of different types of injuries in total cases. In the situations of subjects with single injuries, two out of three had head and neck injuries, while one had an abdominal injury. However, in cases with numerous injuries, include different locations based on the frequencies and percentages shown in Table-V.

TABLE-I

Group wise distribution of our subjects (n=188)

Sr. No	Age (in groups)	Number	Percentage (%)
1.	< 11 years	16	8.5
2.	11-20 years	32	17.0
3.	21-30 years	52	27.7
4.	31-40 years	24	12.8
5.	41-50 years	14	7.4
6.	51-60 years	16	8.5
7.	> 60 years	34	18.1

TABLE-II

Educational status of the study population

Educational Status	Frequency (n)	Percentage (%)
Uneducated	84	44.7%
Primary	44	23.4%
Secondary	38	20.2%
Higher	22	11.7%

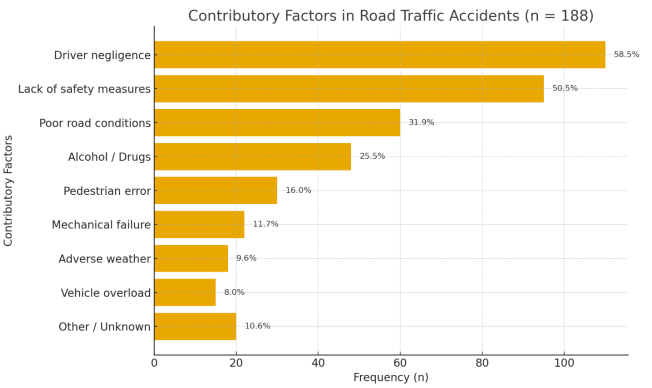
TABLE-III

Socioeconomic status of the study population

Socioeconomic Status	Frequency (n)	Percentage (%)
Poor	108	57.4%
Middle Class	58	30.9%
Well-off	22	11.7%

FIGURE-1

Contributory factors in road traffic accidents (n=188)



Furthermore, 188 instances had a total of 606 injuries, with 90.76% (550/606) being little, 7.92% (48/606) being medium, and 1.32% (8/606) being large, including all types of injuries.

TABLE-IV

Frequencies and percentages of different types of injuries

Sr.No	Type of Injury	Present (%)
1.	Abrasion	112 (59.6)
2.	Contusion	96 (51.1)
3.	Laceration	164 (87.2)
4.	Hematoma	4 (2.1)
5.	Fracture	44 (23.4)

TABLE-V

Frequencies and percentages of different types of regional injuries

Sr.No	Regional Injuries	Frequencies	Percentages
1.	Head & Neck Injures	162	86.17
2.	Lower Extremity Injuries	116	61.70
3.	Upper Extremity Injuries	66	35.11
4.	Abdomen & Pelvis Injuries	54	28.72
5.	Thorax Injuries	44	23.40

FIGURE-2

Frequencies illustrating duration of death following RTA

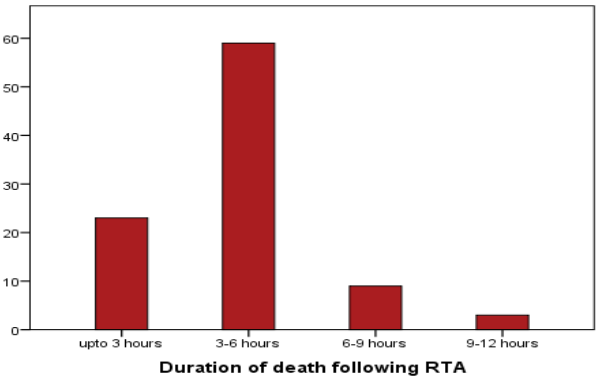


TABLE-VI

Frequencies and percentages of cause of death

Sr.No	Cause of Death	Frequencies	Percentages
1.	Injury to brain and associated vessels	122	64.89
2.	Injury to femoral vessels	22	11.70
3.	Injury to thoracic/abdominal aorta or both	16	8.51
4.	Injury to brain and femoral vessels	10	5.32
5.	Injury to brain and thoracic viscera	10	5.32
6.	Injury to abdominal viscera and associated vessels	4	2.13
7.	Injury to thoracic viscera and associated vessels	2	1.06
8.	Injury to brain and abdominal viscera	2	1.06

TABLE-VII

Association Between Demographic and Contributory Factors with Injury Pattern

Variables	Categories	Single Injury (n=6)	Multiple Injuries (n=182)	P-Value*
Gender	Male (n=176)	4 (2.3%)	172 (97.7%)	0.032
	Female (n=12)	2 (16.7%)	10 (83.3%)	
Age Group (years)	<20 (n=48)	3 (6.3%)	45 (93.7%)	0.041
	21–40 (n=76)	1 (1.3%)	75 (98.7%)	
	>40 (n=64)	2 (3.1%)	62 (96.9%)	
Educational Status	Uneducated (n=84)	2 (2.4%)	82 (97.6%)	0.018
	Primary–Secondary (n=82)	3 (3.7%)	79 (96.3%)	
	Higher (n=22)	1 (4.5%)	21 (95.5%)	
Socioeconomic Status	Poor (n=108)	1 (0.9%)	107 (99.1%)	0.007
	Middle Class (n=58)	3 (5.2%)	55 (94.8%)	
	Well-off (n=22)	2 (9.1%)	20 (90.9%)	
Contributory Factors	Driver Negligence (n=110)	1 (0.9%)	109 (99.1%)	0.021
	Lack of Safety Measures (n=95)	2 (2.1%)	93 (97.9%)	
	Alcohol/Drugs (n=48)	0 (0%)	48 (100%)	
	Mechanical Failure (n=22)	2 (9.1%)	20 (90.9%)	

DISCUSSION

In the current study, 188 cases of road traffic accidents (RTAs) were investigated to determine the frequency, pattern, and contributing variables to injuries among victims in Peshawar. Males predominated (93.6%), with females accounting for only 6.4% of cases. This substantial male preponderance is consistent with national and regional data, which show that males are more likely to participate in RTAs due to their increased exposure to outdoor and vocational activities, as well as risky driving behaviours.[3,5] A similar male preponderance has been documented in research conducted in Pakistan's Lahore, Karachi, and Rawalpindi, as well as India and Nigeria.[6,14]

The majority of the victims in this survey (85.1%) belonged to the urban group, thus showing that Peshawar's traffic density, the government's inefficiency in enforcing traffic rules, and the rise in urbanisation are factors in these accidents. Similar results were seen in the surveys conducted in Karachi[6] and Dhaka.[7]

People aged 21 to 30 years showed the largest number of cases (27.7%), followed by those over 60 years (18.1%).[2] This is consistent with the observation that the young population is a high-risk group due to their frequent travel, overspeeding, and use of two-wheelers.[7,10] The majority of cases regarding the victims in an RTA reported that the age group of the victims between 20 to 40 years in India and Nepal, supported by the findings from the region regarding the cost implications due to unnecessary deaths caused by an RTA.[1,13]

Regarding educational status, it was found that nearly half of the victims (44.7%) were uneducated, while merely 11.7% had higher education. These results agree with previous studies conducted in Pakistan and the South Asian region, which illustrated that low literacy is associated with unawareness of traffic rules and safety regulations.[15,7] Moreover, the presence of persons belonging to the poor socioeconomic class of 57.4% underlines that weaker sections of societies who often travel in public transport and are also denied protection gears remain susceptible to such accidents.[16]

Analysis of injury pattern showed that multiple injuries were significantly more common (96.8%) than single injuries (3.2%), and this agrees with those of Lahore[3] and India[9], suggesting a high-impact injury from the collision. The commonest injury patterns were lacerations (87.2%), abrasions (59.6%), and contusions (51.1%), and this agrees with those from Karachi[3] and Tanzania[11], where external injuries are found to be common due to the application of blunt trauma forces and mechanisms. In terms of body regions, head and neck injuries were commonest (86.2%), followed by lower limbs (61.7%) and upper limbs (35.1%), and this finds agreement with those from India and Iran where cranio-cerebral trauma remains the chief cause of death due to trauma injury.[10,12]

The predominant cause of death in this study was injury to the brain and its accompanying arteries, accounting for 64.9% of deaths, and this corresponds with studies conducted at a national level[2,3] and globally[9,15,17] and highlights the importance of head protection.

In conclusion, the results of this research corroborate worldwide observations that RTAs tend to seriously affect the demographic of young males from lower socioeconomic and educational settings, commonly resulting in the head injury outcome.[18] Greater enforcement of traffic safety regulations and emergency care after an RTA would go a long way towards decreasing morbidity and mortality rates.[19]

CONCLUSION

The study hereby identifies that the prevalence of RTAs in Peshawar is alarming, mainly in young adult males, including both urban and lower socioeconomic backgrounds. The majority of victims suffered from multiple types of injuries. The head and neck were the most frequently implicated. Major cause of death was due to injury to brain and related arteries-a lethal consequence of head trauma. These findings go in accordance with national and international research, pointing to critical preventive initiatives addressing behavioural, infrastructure, and enforcement aspects.

RECOMENDATIONS

The effective interventions should focus on the enhancement of road safety legislation pertaining to helmets, seat belts, speed control, and tough punishment for reckless driving or drug consumption. The public awareness strategy should also focus on knowledge pertaining to road rules, especially in the lower educational and economic strata. Upgradation of emergency trauma care services could also significantly minimize the RTA-related

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Iftikhar Ahmad:** Study design.
2	**Hakim Khan Afridi:** Literature review.
3	**Rabia Khan:** Data analysis.
4	**Syed Ahsan Ali:** Study design.
5	**Sumbal Javed:** Methodology.
6	**Noor Ul Baqi:** Data collection.
7	**Muhammad Wasif:** Paper writing.