

Research Article

Pattern of injuries in different types of victims of road traffic accident in central India: A comparative study

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Abstract

Death due to road traffic accident (RTA) was one of the leading causes of mortality and morbidity in India. In the present cross-sectional study, only the victim using two-wheelers, four-wheelers, and pedestrians were included for comparison to determine the pattern of injuries in these victims of the road traffic accident. There was a predominance of males in all three types of victims of RTA with a peak age of incidence seen in 21-30 years in two-wheeler victims, 41-50 years in four-wheeler victims, and 51-60 years in pedestrian victims. Four-wheeler (HMV/LMV) was the commonest type of offending vehicle involved in all types of victims with collision/ dash as the commonest manner of an accident. Head was the commonest region involved in pedestrian and two-wheeler victims as compared to the thorax in four-wheeler victims of accidents. Abrasion was the commonest surface injury in two-wheeler victims and pedestrians. The laceration was more common in two-wheeler victims as compared to crushed injury in pedestrian victims of road traffic accidents. The brain was the commonest organ involved in two-wheeler and pedestrian as compared to lungs in four-wheeler victims. The liver and spleen were more commonly involved in two-wheeler victims as compared to kidneys and bladder in pedestrian.

Introduction

Deaths due to road traffic accidents (RTA) are one of the major causes of mortality and morbidity all over the world. They ranked third among the leading cause of death in developed countries. Worldwide, every day about 3400 people die due to road traffic accidents (RTA) and predicted to result in the death of around 1.9 million people annually by 2020 [1] and is expected that it will be the 2nd most common cause of disability-adjusted life years by 2020 [2]. Nearly 90% of world's RTA fatalities are occurring in low and middle-income countries, whereas highly motorized countries contribute very little though they accommodate over 60% of world's vehicles [3]. More than 25% of the global accidental deaths occur in the South East Asian region [4]. In India, over 80,000 persons die in traffic crashes annually and over 1.2 million get injured seriously and 300,000 get disabled permanently [4]. Road accidents account for 2.5% of total deaths in India and are among the six leading causes of death [5]. India has the highest incidence of death due to road traffic accidents in Uttar Pradesh (11.4%) followed by Tamil Nadu (11.3%), Andhra Pradesh (10.7%), and Maharashtra (9.6%) [6].

Many works of literature were available about the pattern of injury in road traffic accidents. Some reported that the

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motorized two-wheeler victims are the commonest in RTA [7-9]. Others reported pedestrians as the commonest victims of RTA [10-16]. Thus, different regions have different types of victims of RTA depending on the types of vehicle used, traffic safety rules and congestion, public awareness, and road condition. In the present study, victims using motorized two-wheelers, four-wheelers (LMV- light motor vehicle like car, jeep, etc; HMV- heavy motor vehicle like bus, truck, tractor, etc), and pedestrians were only included and comparison between these three types of victims was carried out to determine the pattern of injuries.

Material and methods

The present cross-sectional study was carried out in the Department of Forensic Medicine at Government Medical College, Nagpur situated in Central India between July-2012 to December-2014 after approval from the institutional Ethics Committee. The present study includes the victims of road traffic accidents (RTA) who were brought for medicolegal autopsy either brought dead or spot dead or hospital death. The RTA cases with decomposed or partial bodies and incomplete history of the accident were excluded from the study. Most of the information like age, sex, detailed history of the accident like the vehicle used by the victim, offending



vehicle, and manner of the accident was available in the Police paper. The information which was not available was taken from the police or relative or friends of the deceased at the time of autopsy. Injuries were recorded concerning location and type of injury, and involvement of internal organs during the autopsy. The victims of RTA were grouped in different types depending on the types of vehicles used by the victims. In the present study, only the victim using two-wheeler and four-wheeler; and the pedestrian were included. The comparison between these types of victims was carried out to determine the pattern of injuries. Data analysis: Data was entered and analyzed in the EPI INFO 2007 software.

Results

The present study includes the victims of road traffic accidents (RTA) who were brought for medicolegal autopsy. The victims of RTA were grouped in different types depending on the type of vehicle used by the victims. In this study, only the victim using two-wheeler and four-wheeler; and the pedestrian were included. The comparison between these types of victims was carried out to determine the pattern of injuries.

Table 1 shows the distribution of different types of victims of road traffic accidents (RTA). The commonest type of victim was the two-wheeler (62.64%) followed by pedestrians in 21.98% and four-wheeler in 13.55% cases of the total road traffic accident during the study period. The comparison between these three types of victims of RTA was carried out to determine the pattern of injuries. The predominance of males was seen in all types of victims; however, females were slightly more common in four-wheelers. The other types of victims like those of the three-wheeler victims (5 cases) and bicycle victims (2 cases) were not included for comparison in the present study.

Table 1: Type of victims of RTA

Type of victim's vehicle	Male	%	Female	%	Total	%
Bicycle	2	0.9	0	0.0	2	0.7
Two-wheeler	146	63.8	25	56.8	171	62.6
Three-wheeler	3	1.3	2	4.5	5	1.8
Four-wheeler	29	12.7	8	18.2	37	13.6
Pedestrian	51	22.3	9	20.5	60	22.0
Total	229	100.0	44	100.0	273	100.0

Table 2 shows the age and sex distribution of different types of victims of RTA. All types of victims were predominantly seen in males with the male: female ratio of 5.8:1 in two-wheeler victims, 3.6:1 in four-wheeler victims, and 5.7:1 in pedestrian victims. The peak age of incidence was found in 21-30 years (33.9%) and 31-40 years (27.5%) in two-wheeler victims; 41-50 years (32.4%) and 31-40 years (24.3%) in four-wheeler victims; and 51-60 years (26.7%) and 41-50 years (23.3%) in pedestrian. The older age above 60 years was more commonly involved in pedestrian victims, whereas the younger age between 11-20 years was more common in two-wheeler victims.

Table 3 shows the distribution of the type of offending vehicle involved in RTA. Type of victim is significantly associated with offending vehicle (p - value < 0.001). Four-wheeler (HMV- heavy motor vehicle/LMV- light motor vehicle) was the commonest type of offending vehicle involved in all types of victims of accident namely pedestrian (66.7%), two-wheeler (52.6%), and four-wheeler victims (43.2%). Two-wheeler was the second commonest offending vehicle, particularly in pedestrian (28.3%) and two-wheeler victims (8.8%). However, there was no offending vehicle in 56.8% of the cases of four-wheeler victims and 35.7% cases of two-wheeler victims; and it occurs mostly due to dash to static object/animal, skid, and fall/tumble of vehicle.

Table 4 shows the distribution of the manner of accidents in different types of victims of RTA. Significantly higher numbers of accidents were seen in two-wheelers (p - value < 0.001). Collision between vehicles was the commonest manner of the accident in two-wheeler victims (64.3%) and four-wheeler victims (43.2%). Dash to non-vehicular objects (tree, animals, road divider) was more commonly seen in four-wheeler victims (32.4%) as compared to two-wheeler victims (13.5%). But skid/fall of the vehicle was noted in about 17% in both two-wheeler and four-wheeler victims.

Table 5 shows the distribution of involvement of various regions of the body in different types of victims of RTA. Head was the commonest region involved in pedestrian (65%) and two-wheeler victims (61.4%) followed by thorax in 56.7% and 59.6% respectively. Whereas, thorax (59.5%) was the commonest region involved in four-wheeler victims followed by the head region (51.4%). Abdomen was involved in a

Table 2: Age and gender distribution of different types of victims of RTA

Age in years	Two-wheelers (n = 171)				Four-wheelers (n = 37)				Pedestrian (n = 60)			
	M	F	T	%	M	F	T	%	M	F	T	%
00-10	3	1	4	2.3	0	1	1	2.7	2	0	2	3.3
11-20	15	2	17	9.9	1	1	2	5.4	2	0	2	3.3
21-30	50	8	58	33.9	7	1	8	21.6	6	1	7	11.7
31-40	38	9	47	27.5	7	2	9	24.3	8	3	11	18.3
41-50	20	3	23	13.5	10	2	12	32.4	13	1	14	23.3
51-60	15	1	16	9.4	3	0	3	8.1	12	4	16	26.7
61 & above	5	1	6	3.5	1	1	2	5.4	8	0	8	13.3
Total	146	25	171	100.0	29	8	37	100.0	51	9	60	100.0
%	85.4	14.6	100.0		78.4	21.6	100.0		85.0	15.0	100.0	

Chi square test – 36.58, degree of freedom – 8, p - value – 0.0000137 (< 0.001)



Table 3: Type of offending vehicle

Offending vehicle	Two-wheeler		Four-wheeler		Pedestrian	
	N	%	N	%	N	%
Bicycle	2	1.2	0	0.0	0	0.0
2 wheeler	15	8.8	0	0.0	17	28.3
Three-wheeler	3	1.8	0	0.0	3	5.0
Four-wheeler (LMV+HMV)	90	52.6	16	43.2	40	66.7
No offending vehicle	61	35.7	21	56.8	0	0.0
Total	171	100.0	37	100.0	60	100.0

Fisher's exact < 0.001.

Table 4: Manner of accident.

Manner	Two-wheeler		Four-wheeler		Pedestrian	
	N	%	N	%	N	%
Collision/ dash by the offending vehicle	110	64.3	16	43.2	60	100.0
Skid/ tumble/ fall of vehicle	29	17.0	6	16.2	0	0.0
Dash to non-vehicular object	23	13.5	12	32.4	0	0.0
Fall from moving object	9	5.3	3	8.1	0	0.0
Total	171	100.0	37	100.0	60	100.0

Fisher's exact < 0.001

Table 5: Involvement of different regions of the body in RTA.

Regions	Two-wheeler		Four-wheeler		Pedestrian	
	N	%	N	%	N	%
Head	105	61.4	19	51.4	39	65.0
Thorax	102	59.6	22	59.5	34	56.7
Abdomen	70	40.9	16	43.2	26	43.3
Extremities	76	44.4	10	27.0	30	50.0
Pelvis	8	4.7	6	16.2	16	26.7

range of 40% - 43% in all types of victims of RTA. However, extremities and pelvis were more commonly involved in pedestrian victims.

Table 6 shows the distribution of surface injuries in different types of victims of RTA. Abrasion was the commonest surface external injuries in two-wheeler victims (84.2%) and (pedestrian victims (80%). Contusion and abrasion were the commonest external injuries in four-wheeler victims (59.5% each). Lacerated wound was more common in two-wheeler victims (34.5%) and crushing injuries were more in pedestrian victims (16.7%) and four-wheeler victims (5.4%). There was no surface injury in 8.1% of four-wheeler victims and 6.7% of pedestrian victims.

Table 7 shows the involvement of internal organs/ bones in different types of victims of RTA. The brain was the commonest organ involved in two-wheeler victims (57.9%) and pedestrian victims (55%). Lungs were the commonest organs involved in four-wheeler victims (54.1%). The liver and spleen were more commonly involved in four-wheeler victims; whereas kidneys were more commonly injured in pedestrian victims. Intestines were more commonly involved in four-wheeler victims, whereas bladder was involved more commonly in pedestrian as compared to other types of victims of RTA. Among the bone involvement/fracture, chest bone was the commonest bone involved in all three types of victims of RTA ranged between 54% - 57%. Pelvic bone and limb bones were more commonly involved in pedestrian victims as compared to other victims of RTA.

Table 6: Distribution of types of external injuries.

External injuries	Two-wheeler		Four-wheeler		Pedestrian	
	N	%	N	%	N	%
Abrasion	144	84.2	22	59.5	48	80.0
Contusion	104	60.8	22	59.5	25	41.7
Lacerated wound	59	34.5	4	10.8	9	15.0
Crushed injury	3	1.8	2	5.4	10	16.7
No injury	3	1.8	3	8.1	4	6.7

Table 7: Involvement of internal organs/ bone

Internal organs/ bone	Two-wheeler		Four-wheeler		Pedestrian	
	N	%	N	%	N	%
Brain/Intracranial hemorrhage	99	57.9	19	51.4	33	55.0
Lungs	82	48.0	20	54.1	28	46.7
Heart	9	5.3	0	0.0	6	10.0
Liver	62	36.3	11	29.7	16	26.7
Spleen	31	18.1	5	13.5	7	11.7
Kidneys	23	13.5	4	10.8	17	28.3
Pancreas	4	2.3	0	0.0	2	3.3
Stomach	3	1.8	1	2.7	2	3.3
Small intestine	6	3.5	7	18.9	5	8.3
Large intestine	7	4.1	7	18.9	4	6.7
Bladder	8	4.7	6	16.2	16	26.7
chest bones#	95	55.6	20	54.1	34	56.7
Spine Fracture	5	2.9	0	0.0	2	3.3
Pelvic fracture	2	1.2	3	8.1	6	10.0
Limb bones#	56	32.7	10	27.0	24	40.0

Discussion

Death due to road traffic accidents (RTA) are one of the leading causes of mortality and morbidity in India. Jha, et al. [17] noticed two-wheeler, pedestrian, and four-wheeler (LMV/HMV) as the commonest victims of road traffic accidents in South India. Tandle, et al. [18] reported two-wheeler victims as the commonest victims of RTA followed by four-wheeler victims and pedestrians in the Yavatmal district of Maharashtra. Singh, et al. [7], Dandona and Mishra [8], and Pathak, et al. [9] reported that two-wheeler riders as the commonest victims of accidents. However, other authors reported pedestrians as the commonest type of victims of RTA [10-16]. This difference may be due to good traffic sense among the people walking on the road along with the traffic control in the study area. Millo, et al. [19] found pedestrians (39%) as the commonest type of victims followed by three-wheeler drivers (26%) and two-wheeler drivers (14%). In the present study, the commonest type of victims of RTA was two-wheeler victims (62.6%) followed by pedestrian (22%) and four-wheeler victims (13.6%). The comparison between these three commonest types of victims of RTA was carried out to determine the pattern of injuries. Lilhare and Swarnkar [20] also reported motorcyclists (two-wheelers) as the commonest victims of RTA followed by LMV/HMV (four-wheeler) and pedestrians in Wardha district of Maharashtra.

In general, male predominance was seen in victims of RTA with the highest incidence in the age group of 21-30 years [9-14,21,22]. This is because the males are more exposed to outdoor activities and travel to the workplace to earn bread and butter for the family, whereas females remain engaged in



the household work. Moreover, young males are more rash and fast in driving vehicles, while females are more careful and attentive during driving. However, Banerjee, et al. [11] reported high incidence in the age group of 31-40 years with a male-female ratio of 6.14:1. Similarly, Singh, et al. [16] and Gupta, et al. [15] too reported that males were 7 to 8 times commoner as compared to females; and Reddy, et al. [23] reported a male-female ratio of 11.5:1 with 50% cases in ages between 21 to 40 years. In the present study, the predominance of males was found in all three types of victims of RTA with the peak age of incidence seen in 21-30 years (33.9%) in two-wheeler victims, 41-50 years (32.4%) in four-wheeler victims and 51-60 years (26.7%) in pedestrian victims. The older age above 60 years was more commonly involved in pedestrian victims, whereas the younger age between 11-20 years was more common in two-wheeler victims. The young riders are at peak of their creativity and usually take unwarranted risk causing more fatalities of young two-wheeler riders as compared to other types of victims of RTA. Similarly, old-aged pedestrians usually lack judgment and vision leading to more accidents while crossing or walking on the road. Naik, et al. [24] and Jakhar, et al. [25], also noticed male predominance in two-wheeler victims with the highest peak in the age of 21-30 years followed by 31-40 years. Mandal and Yadav [26] observed male predominance in pedestrian victims with the highest incidence in the age group of 41-50 years. Lihare, et al. [20] too reported male predominance with the peak age of 41-50 years (27.8%) in four-wheeler (LMV/HMV) victims of RTA.

As far as the offending vehicle for the accident, the four-wheeler (HVM/LMV) was the commonest type of offending vehicle involved in all three types of victims of RTA. Two-wheeler was the second commonest offending vehicle, particularly in pedestrian (28.3%) and two-wheeler victims (8.8%) of RTA. Most of the authors [11-14,23] also noted heavy motor vehicle motor like truck and buses as the commonest type of offending vehicle seen in 35% to 60% cases of accident. This is mainly because of the greater impact of trucks/buses due to their weight and speed leading to fatal outcomes of the victim of accidents. However, Raoof Abdul, [27] noted LMV (car) as the commonest offending vehicle in 36.3% of cases followed by HVM (truck) in 29% and two-wheelers in 14.5% of cases. Jha, et al. [17], Khade, et al. [28], and Mandal and Yadav, [26] reported four-wheeler (HVM/LMV) as the commonest offending vehicle in 75% followed by two-wheeler in 25% of cases in pedestrian victims. Misra, et al. [29] noted that 53.4% of the victims were using motorized two-wheelers but 39.3% of the offending/colliding vehicle was four-wheeler. However, there was no offending vehicle in 56.8% of four-wheeler victims and 35.7% of two-wheeler victims; mostly due to dash to static object/animal followed by skid and fall/ tumble of vehicle.

In the present study, collision/dash by offending vehicle was the commonest manner of accident in pedestrian (100%), two-wheeler victims (64.3%), and four-wheeler victims (43.2%) of RTA. Dash to non-vehicular objects (tree,

animals, road divider) was more commonly seen in four-wheeler victims (32.4%) as compared to two-wheeler victims (13.5%). These findings are similar to those reported by other researchers [8,12,31,32]. Sharma, et al. [32] noted dash by offending vehicle (usually HVM) in 40% of accidents and slips on roads were responsible in 11% of cases of accident. Jakhar, et al. [25] reported crashes with four-wheelers as the commonest manner of accident in two-wheeler bike victims followed by skid of the bike. Mandal and Yadav, [26] noted impact by offending vehicle (mostly LMV/HVM) as the commonest manner of accident in pedestrians. Crandall, et al. [33] found that crashes between vehicle and pedestrian are responsible for more than a third of all traffic-related death and injuries worldwide.

In two-wheeler and pedestrian victims, the commonest region involved was the head followed by thorax. Whereas, the commonest region involved was the thorax followed by the head in four-wheeler victims of RTA. Jakhar, et al. [25] also noted the head as the commonest region involved followed by thorax in pedestrian victims of RTA. However, Mandal and Yadav, [26] found lower limbs as the commonest region involved followed by head and thorax in pedestrian victims. Lihare, et al. [20] observed that extremity was the commonest region involved followed by craniocerebral (head) region in two-wheeler and pedestrian victims of RTA, but the head was the commonest region involved in pedestrian victims followed by extremities. Jha, et al. [17] reported head injuries were more common among pedestrian and two-wheeler victims. Ravimuni, et al. [34] noted that injuries to the head occurred in most cases (69.9%) of two-wheeler victims followed by limb injuries (63.2%), abdominal injuries (26.2%), and thoracic injuries (25.2%).

In the present study, abrasion and contusion were the commonest surface injuries in all three types of victims of RTA. Laceration injuries were more common in two-wheeler victims and crushed injuries were more common in pedestrians. Ravimuni, et al. [34] reported that abrasion was the commonest surface injury in two-wheeler victims of RTA. Kaul, et al. [30] noticed that crushed injuries were common in pedestrians, and avulsion/degloving injuries (laceration) were recorded more commonly with motorcyclists (41.5%) followed by pedestrians. However, Mandal and Yadav, [26] noted fracture as the commonest injuries sustained in the pedestrian victims followed by laceration, abrasion, and contusion. No surface injuries were more common in four-wheeler and pedestrian victims of RTA. This is probably due to more number of motorized two-wheeler victims who were more prone to get external injuries on a tar road.

In respect of involvement of organs, the brain was the commonest organ involved in two-wheeler (57.9%) and pedestrian victims (55%) as compared to lungs in four-wheeler victims (54.1%) of RTA. Kidneys and bladder were more commonly involved in pedestrian victims; whereas liver and spleen were marginally more involved in two-wheeler victims of RTA. Ravimuni, et al. [34] reported liver was more



commonly injured than any other organ of the body in two-wheeler victims. Banerjee, et al. [11], Chaudhari, et al. [10], Husaini, et al. [35], Reddy, et al. [23], and Raoof Abdul, [27] also found the liver as the commonest abdominal organ injured in RTA. Similarly, chest bones (ribs and sternum) were the commonest bone to have a fracture in all types of victims of RTA, but pelvic and limb bones were more commonly involved in pedestrian victims as compared to other types of victims of RTA. Other studies [23,27,35] too reported rib fracture as the commonest internal injury followed by an injury to the lungs in thoracic region. However, Singh and Dhatarwal, [13] found fracture of ribs in only 36.9% and lung injury in 29.8% of cases.

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