AN EPIDEMIOLOGICAL STUDY OF FATAL ROAD TRAFFIC ACCIDENTS IN ALLAHABAD REGION

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ABSTRACT

A total of 2246 medico-legal autopsies were conducted in the mortuary of SRN Hospital of MLN Medical College, Allahabad, during one year study period, out of which nine hundred and fifty (42.29%) cases were due to fatal road traffic accidents (RTA). Only 52.21% of victims could be hospitalized and rest of them (47.79%) either succumbed on the spot or died on way to hospital. 32.42% of RTA victims survived beyond 24 hours and a very small percentage (11.15%) of the hospitalized cases could receive any specific treatment prior death.

Male / Female ratio was 3:1. The principal age group involved in fatal RTA was 25-44 years, 33.68%, and least involved were extremes of ages i.e. below 10 years, 5.38%, and above 65 years, 7.37%. Maximum fatalities were in winter months 42.64%, followed by summer 32.73%. Single vehicle was responsible for 83.15% of cases followed by double vehicles 14.74% and triple vehicles accounted for only 0.31%of cases. Maximum fatalities 83.05% were recorded on highways and only 6 cases occurred in lanes. Pedestrians accounted for 35.79% of total fatalities followed by motorized two wheelers (motor cyclists, scooterist, mopeds etc) 30.53% of cases. The majority of fatal RTA were due to heavy vehicles (trucks, buses etc), 58.52% of cases followed by light vehicles (car, Jeep, van, taxi etc) 21.58%. The site of initial impact was frontal in 45.14% followed by rear in 25.89%. Regarding external injuries, primary impact injuries were observed in 455 cases, secondary impact injuries in 505 cases and secondary injuries in 697 cases. More often, the lower extremities and pelvis were involved in the primary impacts, and head & neck in the secondary impacts while secondary injuries were located mostly in the lower extremities. Mostly pedestrians 42.20% suffered crushing injuries, and lower extremities were mostly crushed 29.64% followed by head & neck 19.86%. Avulsion or degloving injuries were recorded more commonly with motorcyclists 41.45% followed by pedestrians 34.01%. Contre-coupe injuries of the brain were recorded in 9.03% of cases. The heavy vehicles were mostly responsible for causing a large number of visceral injuries. Brain was found to be injured in a majority of cases followed by liver and lungs. The victims mostly died of head injuries alone followed by thoraco-abdominal injuries in combination with head injuries.

INTRODUCTION

Death from road traffic injuries (RTI) and in particular Motor vehicle Traffic Accidents (MVTA) have been characterized worldwide as a hidden epidemic which affects all sectors of society [1,2] An estimated 1.26 million people worldwide died in 2000 from RTI, 90% of them in low and middle income countries. In 2000, the RTI mortality rate for the world was 20.8 per 1,00,000 population (30.8 in males, 11.0 in females). The Asia-pacific region accounts for about 60% of global road deaths despite having only 16% of the world's vehicles. In the Americas, it was 26.7 for males and 8.4 for females.[3] In the Americas during 1997-2000 mortality from all land transport accidents was the tenth leading cause of death in the general population.[4] In India, as many of the places can only be accessed by road consequently we will be on roads for extensive period of time, will experience seemingly chaotic road traffic system and will be more prone to road traffic accidents (RTA)

Road traffic accidents are a public health issue and cost a lot to individuals, families, communities and nations. The estimated cost is around 1-2% of a country's GNP in lower income countries.[2] In majority of cases, road accidents are largely preventable and

are usually caused by human errors including alcohol drinking, over taking and speeding, thus highlighting strict implementation of road safety measures.

The objective of this study is to assess prevalence of fatal road traffic accidents (RTAs) reporting to the hospital and a detailed analysis of the epidemiological factors in relation to victims, vehicles and sites of impacts, etc. Besides, features pertaining to hosts (road users), the agents (vehicles) and the environmental condition (road, seasons, months etc), place of death and treatment provided to the victims along with their period of survival will be studied.

MATERIALS AND METHODS

For the purpose of study, a road traffic accidents is defined as any vehicle accident occurring on a public road or highway and includes vehicle accidents where the place of occurrence is unspecified.[5] For the present study, dead bodies of RTA brought to the mortuary of the SRN Hospital, MLN Medical College, Allahabad for medico legal post mortem examination from various police stations of Allahabad district during the period Dec. 2003 to Nov. 2004 were taken into the consideration. The epidemiological features pertaining to victim e.g. age, sex, type of road users, type of vehicle involved in the accident and injuries caused to the victims, the site of impacts of the vehicle were noted. The facts concerning circumstances of the accidents and other relevant data about the cases were collected from the papers sent by the police namely Inquest report and FIR and details from concerned police constables, the relatives, attendants, friends and others accompanying the dead body.

All the dead bodies were thoroughly examined for external and internal injuries including bones and joints. The injuries were categorized according to principal sites and organ involved. The nature of injuries and possible cause of death was explored. Additionally, place of death of the RTA victim, nature of the treatment provided to the victims, and the period of survival of victims following RTA was recorded by police inquest and medical record.

A detailed Proforma for the purpose of recording history, epidemiological data and the details of external and internal injuries etc was prepared for the purpose of filling observations of the present study. Cases with incomplete records were excluded for the purpose of the present study.

RESULTS

A total of 2246 medico legal autopsies were conducted during one year study period at SRN Hospital mortuary, out of these only 950 cases of fatal RTA were included in this study. Thus, total RTA were 42.29% of medico legal autopsies conducted.

The age and gender distribution was shown in Table-1. Male outnumbered females and male/female ratio was approximately 3: 1. There were 156 children (16.43%) below the age of 15years. The maximum number of RTA fatalities 539 (56.73%) were recorded in the age group of 15-44 years of age, of which age group 25-44 years accounted for maximum 33.68% of total fatalities, whereas only 70 (7.37%) casualties were noted in person above 65 years of age.

Distribution of different types of road users involved in fatal RTA was shown in Table-2. Majority of victims were pedestrian 340 cases (35.79%) followed by motor cyclists/scooterists (30.53%). Pedal-cyclists were 52 (5.47%) whereas others and unknown comprised of 54 cases.

Table-3 depicted distribution of different types of vehicles involved in RTA. Majority of the vehicles involved in the RTA were heavy vehicles (trucks, oil tanker, motor buses) 58.52%, followed by light-vehicles (taxi, car, jeep, van etc) 21.58%, other vehicles (tractors, tampos, bullockcarts, road-roller, rickshaw) were involved in 2.63% of cases. RTA due to unknown vehicles was 7 in numbers (0.74%).

Table-4 displayed distribution of victims in relation to the number of vehicles involved. Single vehicle was involved in 790 cases (83.15%) followed by double vehicle 140 cases (14.74%), only in 3 cases three vehicles were involved, whereas in 18 cases no clues about number of vehicles involved.

Table-5 showed distribution of accidents in relation to types of roads. A maximum of 789 cases (83.05%) were recorded on highways followed by ordinary roads. Only 6 cases occurred in lanes, whereas only 2 RTA were observed at other places like shed, parking area, field etc.

Effect of seasonal variation in relation to number of victims was displayed in Table-6. Winter season (Nov to Feb) recorded maximum number 405 cases (42.64%) followed by summer season (March to June) 311 cases (32.73%).

Table-7 depicted place of death in relation to RTA victims. A total of 250 cases (26.32%) died on spot, 204 victims died on the way to the hospital whereas 496 cases (52.21%) died in the hospital. Regarding the type of treatment provided to the 496 admitted victims of RTA; 390 cases (78.63%) received general management including first-aid and only 106 cases (21.37%) could receive specific management including major operations.

Table-8 depicts period of survival following accident. Apart from 250 cases that died on the sport, 382 cases (40.21%) died with in 24 hours and 308 cases (32.42%) survived beyond 24 hours but these too died within 21 days in only 813 cases there was a history of impact of the responsible vehicle. In 367 cases site of initial impact of the responsible vehicle was front followed by rear of vehicle and then side of vehicle.

Table-9 showed distribution of external injuries amongst different types of road users. In the present study a total of 505 cases sustained secondary impact injuries whereas only 455 cases sustained primary impact injuries. Only those cases were recorded where impact injuries were identified. On autopsy it was observed that primary impact injuries were present on 785 body areas and were mostly seen in lower extremities, pelvis, upper extremities and shoulder. Whereas, secondary impact injuries were identified on 710 body areas and majority of secondary impact injuries were recorded in the head and neck region followed by upper and lower extremities. Back of body was minimally involved. A majority of 697 cases (73.36%) received secondary injuries, usually pedal cyclists and motorcylists sustained secondary injuries.

Out of 950 cases, a total 353 cases received crushing (run-over) injuries. It was further observed that out of 340 pedestrians involved in RTA, 149 cases had run over injuries and were worst sufferers. Motorized two wheelers 105 cases followed this whereas vehicle occupants received 71 crushing injuries. Besides, in our study a total of 147 cases received degloving or avulsion injuries and 85 cases got contre-coupe injuries and again pedestrians were mostly involved. As far as visceral injuries were concerned brain was more commonly involved followed by liver, lung, and spleen respectively.

It was observed that in cases of fatal RTA, most cases received multiple injuries. Head injury alone was the cause of death in 277 cases (29.15%) whereas head injury in association with thoraco-abdominal injuries was other important cause of death. Injury to non-vital organs was responsible for only 7 cases.

DISCUSSION

With exploding population, increasing registration of automobiles every month, rampant encroachment of roads, nasty tendency of violating traffic rules and chaotic traffic systems have greatly contributed rapid strides in road traffic accidents. An increased incidence of RTA has direct repercussion on increased fatalities observed in RTA. Road traffic injuries are one of the leading causes of death in the world.[6] world wide the number of people killed in road traffic crashes each year is estimated at almost 1.2 million, while the number of injured could be as high as 50 million.[7] In India over 80,000 person die in traffic crashes annually, over 1.2 million are injured seriously and about 30,000 disabled permanently.[8]

The present study carried out in this part of Northern India revealed that during one-year study period 950 fatal RTA have occurred accounting for 42.29% of total medicologal autopsies. This has reflected major public health problem. Singh and Dhattarwal[9] have reported a lower incidence 29.8% i.e. 450 fatal road traffic accidents out of 1510 total medicolegal autopsies conducted. The average crude mortality rate from motor vehicle traffic accidents (MVTA) observed during 1985-2001 ranged 22.8 & 21.9 per 1,00,000 population in Brazil and Venezuela.[5] Traffic related deaths in Kathmandu steadily increased during 1981-2003 the annual increase of the number of traffic related deaths was 3.88.[10] Similarly, in Netherlands, injuries are the main cause

of death in the age category of 5-29 years and approximately 5200 persons die of injuries each year.[11] Nilamber Jha[12] in a study of RTA at JIPMER reported that out of a total of 544 RTAs there were 26 fatalities. However a decreasing trend has been observed in united states with the estimated injury fatality rate for workers in all occupations 9 in 1,00,000 in 1988 compared with 8 in 100,000 in 1993.[13] The time of accident has not been recorded in virtually all the cases in the present study because of variability of time narrated by relatives, friends, police personnel and others concerned. Besides, in casualties occurring at dead of night or early hours of day the exact time could not be made out.

Our findings that males outnumbered females in the ratio of 3:1 can be explained by the fact that males lead a more active life and keep themselves most of the time outdoors to earn bread and butter for families besides they are more involved in activities such as driving and traveling. On the contrary, females mostly keep themselves indoor mostly due to cultural background, lack of industries and low potential for employment rate owing to poor literacy, along with the tendency that some male members mostly accompany females and extra precautions are taken on roads. These are reasons for their less mortality in RTA. Our findings are in general agreement with those of others. [1,5,9,14,15] Singh and Dhattarwal[9] has however observed a M/F ratio of 9:1 contrary to our ratio of 3:1. Moreover, excess male mortality increases the number of widows and orphans and exposes them to a higher risk of economic difficulties.

In the present study, highest incidence of RTA fatalities have been observed in the age group of 25-44 years (33.68%) and lowest incidence in the children below 10 years (5.38%) and persons above 65 years of age (7.37%). This may be due to the fact that persons of 25-44 years are group lead more active life and keep themselves outdoors most of the time. Besides they have a universal habit of taking risks like boarding a moving vehicle, traveling on footboard of vehicle, crossing the roads carelessly and risky speed driving etc. Involvement of children 10-14 years (11.05%) is owing to the fact that children have the universal urge to play on roads, violate traffic rules and poor judgment while crossing roads. Least fatalities in older persons is due to more experience, more traffic sense, less tendency to take undue risks and they remain mostly indoors and lead less active life. Similarly, lesser involvement of children below 10 years may be for they are accompanied by some member of the family while on road. Our findings are in close accordance with those of other.[15,14,11,9,4,3,2] Although, Singh & Dhattarwal[9] has observed that two third of cases are in the age group of 11-40 years but the commonest age group in variance to our findings, is 21-30 years (27.3%) followed by 31-40 years (20.6%). Our findings are not in agreement with Gissane & Bull[16] who have observed highest incidence in person above 60 years of age. The reasons assigned for this are impairment of vision, hearing, reaction time and speed of movements. Our findings that RTA mortalities are more in younger population are in contrast to those of world report on road traffic injury prevention; WHO, Geneva, 2004[7] which mention overall elderly people the more likely to be killed or seriously disabled than younger people due to lack of resilience.

It has been observed that pedestrians accounted for maximum number of fatalities 35.58% followed by motorized two wheelers (motor cyclist scooterist etc) and lowest incidence have been noted among pedal cyclists (5.47%). Pedestrians being the most common victims can be explained by the fact that there is a lack of proper footpath or roads and presence of vendors and other commercial instillation by the side of the roads. Besides, majority of the road users are pedestrians and thus are comparatively more exposed to the risk of accidents. Furthermore, pedestrians are mostly of low or lower middle socioeconomic class who are illiterate and lack traffic sense. Various workers[15,14,13,12,9] in the field have noted that pedestrians are the most common victims in RTA. Eke N et al,[14] have also observed that pedestrians are mostly involved, females constituted 41% of pedestrians and those below 15 years of age are more susceptible to death in RTA. Motor cyclist/scooterists comprise of second most commonly involved group in fatal RTA reason being careless speed driving, thrill seeking, overtaking and less stability of the vehicle. Besides, these vehicles are mostly used by 15-44 years age group. Pedal cyclist are more cautious road users hence least involvement. In contrast, studies in developed countries have observed that vehicle occupants are more commonly involved in RTA due to the fact that motorization has been to such a great extent that pedestrian are scarce on the road and there is much improvement in highway construction and automobile engineering allowing very high speed to the automobile.

Heavy vehicles (trucks, oil tanker, lorries, bus etc) have been found to be mostly responsible for 58.52% of cases followed by light vehicles (car, jeep, van, taxies) 21.58% of fatal RTA. This can be attributed to their high speed, presence of single space roads, driver's fatigue, drinking alcohol etc. Our findings are in general agreement with those of others[14,9,5] that heavy vehicles are responsible for maximum fatalities. In a study at U.S.[13] farm vehicle fatalities have been identified as a significant problem and

during 1988-1993, in rural areas 444 farm vehicle occupants have been killed in addition 238 occupants of other vehicles or pedestrians are killed in collision with farm vehicles. However, in the present study only minimal involvement of farm vehicles (tractors, tractor trolleys, thrasher etc) have been observed even in rural areas.

In the present study role of various contributing factors has not been defined. The role of alcohol in impairing driving ability has been well documented and the impairment enhances as blood alcohol level rises. We have not worked out alcohol levels and its possible role in our study. Eke N et al,[14] have observed that contribution of alcohol is relatively uncertain as only six cases are documented in their study. However, Kochar A et al,[15] have noted that amongst postmortem cases, 28.3% of the victims reportedly have a history of consuming alcohol within 6 hours before the accident. Soderstrom[17] have observed that etiological relation between alcohol use and the causation of vehicular crashes (both fatal and non-fatal) is well established. Driver fatigue or sleepiness is another widespread and serious problem contributing to RTA and this together with obstructive sleep apnea increases risk of RTA several times.[18,19]

Mostly one vehicle has been involved in great majority (83.15%) of fatal RTA whereas in 0.31% cases three vehicles are involved in 18 cases (1.89%) no clues about number of vehicle involved. No reports are available on this aspect. Present study depicts that largest number (83.05%) accidents took place on highways and least number in lanes. This can be explained on the basis that highways are the busiest roads with heavy traffic loads, lack proper footpath facility and drivers are tempted to drive at high speed. On the other hand, lanes allow fewer numbers of vehicle hence reduced incidence of RTA. Our findings are in agreement with others.[9]

Regarding seasonal variation in fatal RTA we have found that 42.64% of the fatalities are recorded in winter months, as during winter months in this region there is longer hours of darkness, poor visibility to drivers at night and early hours of the day due to foggy weather conditions and slow reaction time due to extreme cold affecting both drivers and road users. Our finding are in agreement with those of Singh & Dhattarwal.[9] However, Eke N et al,[14] have reported that 70% of the accidents have occurred in rainy season. Similarly Jha et al,[11] have reported that during October, November and December (rainy months) 22.7% RTA have been recorded.

In the present study, 26.32% died on the spot. This reflected severity of crash. Singh & Dhattarwal[9] has reported in their study that 15.4% victims died on the spot and rest of the cases were admitted to the hospital contrary to our findings that 21.47% died on way to hospital. 52.21% victims have died in the hospital of these only 106 victims have received specific management including major surgery, whereas 78.63% victims have received only general management. This highlights the need of establishment of specialized trauma centres in big cities so that prompt specific treatment can be offered to the RTA victims. Our study have also shown that 204 victims (21.47%) have died a way to hospital this itself speak for the need of prompt and safe transportation of the victims with facilities of general management and resuscitation on way to hospital.

A total of 382 cases (40.21%) have died within 24 hours and only 308 (32.42) survived beyond 24 hours. For the purpose of the study RTA victims who have died within 21 days of accident have been taken into consideration. Our findings are in conformity with those of Singh & Dhattarwal[9] who have also observed that 77.1% of victims have died within 48 hours of admission to hospital.

Regarding distribution of injuries amongst RTA victims, it has been observed that multiple injuries involving different parts of the body are more commonly seen. Involvement of multiple parts of the body in fatal RTA has also been observed by others.[9;14] Furthermore, extremities injuries taken together have outnumbered other injuries on the body parts. Of the external injuries, secondary impact injuries are more common compared with primary impact injuries. A major chunk of victims have received secondary injuries in 697 cases. This is because a single victim can have more than one impact injuries and also have secondary injuries as well. Other workers [14,12,9] have also observed multiple injuries amongst RTA. Abrasions, laceration, fractures, dislocations are the injuries more commonly observed in descending order. This is in conformity with others workers.[9] As regards visceral injuries, brain is more commonly involved followed by liver, lung and spleen. Eke N et al,[14] have observed 543 head injuries in 1601 casualties, whereas Singh & Dhattarwal[9] have noted an incidence of 77.6% head injuries in their study. This establishes that head injury is most common in fatal RTAs. Head injury alone or in combination with thoraco-abdominal injuries is

the major causes of death. Our findings are in conformity with Vander Sluis et al,[11] who have reported that severe brain injuries are the most important cause of death and chiefly affected car occupants and cyclists.

However to a large extent road traffic accidents are preventable and can be influenced through a rational national policy on road safety, stricter licensing policy especially for heavy vehicle, and a greater awareness of different kinds of road-users about traffic rules and use of protective gears like safety belts and motorcycle helmets. Of course, construction of well planned road systems, safe vehicle design implementation of road safety measures and curbing intoxication and drug abuse amongst drivers are the need of hour to check the rising graph of fatal road traffic accidents

In summary, since road users are not uniform population these are exposed to different kinds of hazards depending upon conditions prevailing in that region hence present different epidemiological parameters.

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Table-1 Showing Age and Sex Distribution in RTA

S.N.	Age group (Years)	Sex		Victims	
		Male	Female	No.	%
1	<10	30	21	51	5.38
2	10-14	59	46	105	11.05
3	15-24	165	54	219	23.05
4	25-44	270	50	320	33.68
5	45-64	150	35	185	19.47
6	65 &>	39	31	70	7.37
	Total	713	237	950	100

Table-2 Showing different types of Road users involved in RTA

S. N.	Type of road users	No. of cases	%
1	Pedestrian	340	35.79
2	Pedal –cyclists	52	5.47
3	Motor cyclists / Scooterists	290	30.53
4	Vehicle occupants	214	22.53
5	Others	40	4.21
6	Unknown	14	1.47
	Total	950	100

Table-3 Showing types of vehicle involved in RTA

S. N.	Type of vehicle involved	No.	%
1	Heavy vehicles. · Truck, oil tanker. · Motor bus.	 375 181	 39.47 19.05
2	Light vehicles (Taxi, car, Jeep etc)	205	21.58
3	Two wheeled vehicles	157	16.55
4	Other	25	2.63
5	Unknown	7	0.74
	Total	950	100

Table-4 Showing number of victims in relation to vehicles involved

No. of vehicles	Victims

involved	No.	%
Single	790	83.15
Double	140	14.74
Triple	3	0.31
Unknown	18	1.89
Total	950	100

Table-5 Showing number of accidents in relation to types of Roads

Types of Roads	No.	%
Highway	789	83.05
Road	150	15.58
Lane	6	0.63
Other places	2	0.21
Unknown	5	0.53
Total	950	100

Table-6 Showing number of victims in different seasons

Season	No.	%
Summer (Mar. to Jun)	311	32.73
Rainy (July to Oct.)	234	24.63
Winter (Nov. to Feb.)	405	42.64
Total	950	100

Table-7 Showing place of death and type of treatment provided to the admitted victims

S.N.	Place of death	RTA Victim	
		No.	%
1.	Spot	250	26.32
2.	On way to the hospital	204	21.47
3.	Hospital	496	52.21
	Total	950	100

Type of treatment	Admitted Victims	
	No.	%
Gen. Manag.	390	78.63
Spec. Manag. (Major Op.)	106	21.37
Total	496	100

Table-8 Showing period of survival following accident and site of initial impact of the responsible vehicle

S.N.	Period of survival	Cases		Site of initial impact	Cases	
		No.	%		No.	%
1.	Spot death	250	26.32	Front	367	45.14
2.	Died within 24 hours	382	40.21	Rear	210	25.83
3.	Survived beyond 24 hours	308	32.42	Side	57	7.01
4.	Unknown	10	1.05	Unknown	179	22.02
	Total	950	100	Total	813	100

Table-9 Distribution of external injuries amongst different types of road users

S. N.	Nature of external injury	Pedestrian		Pedal cyclists		Motor cyclist		Other		Unknown		Total
		No.	%	No.	%	No.	%	No.	%	No.	%	No.
1	Primary impact injuries	165	17.37	95	10.0	82	8.63	50	5.26	63	6.63	455
2	Secondary impact injuries	176	18.53	103	10.84	121	12.74	47	4.95	58	6.10	505
3	Secondary injuries	158	16.63	183	19.26	209	22.00	77	8.11	70	7.36	697