Original Article

TRENDS OF FATAL ROAD TRAFFIC ACCIDENTS IN CENTRAL INDIA
Dr. NB Kumar, Dr. PS Ghormade, Dr. CV Tingne, Dr. AN Keoliya

Authors

Dr. N. B. Kumar, Assistant Professor, Department of Forensic Medicine, Indira Gandhi Government Medical College, Nagpur

Dr. P. S. Ghormade, Assistant Professor, Department of Forensic Medicine, Indira Gandhi Government Medical College, Nagpur

Dr. C. V. Tingne, Assistant Professor, Department of Forensic Medicine, Indira Gandhi Government Medical College, Nagpur

Dr. A. N. Keoliya, Professor & Head, Department of Forensic Medicine, Indira Gandhi Government Medical College, Nagpur

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Address for correspondence: Dr NB Kumar
naren2014@gmail.com
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Abstract:
During a two year prospective study in central India, 224 autopsy cases of fatal road traffic accidents were studied. Young adult males between the age group of 21-40 years formed the majority (52.71%) of victims and peak incidence occurring between 6pm to 12 midnight (37.50%). Motorcyclists were the most common victims (47.76%) and heavy motor vehicles were the offending agents in most cases (48.21%). Multiple injuries were present in majority of the victims. Extremities suffered more surface injuries than any other body region. Motor vehicle occupants suffered more injuries to thoraco-abdominal region than motorcyclists or pedestrians. Injury to head was responsible for deaths in most cases with more than 50% victims dying in first 24 hours.

Keywords: fatal, road traffic accidents, multiple injuries, motorcyclists, heavy motor vehicles.

Introduction:
Problems related to crash injuries on the road and eventually to the death of the victim of the accident may call upon the entire spectrum of the forensic expertise. The forensic expert is entrusted with the assessment of the injuries, mechanism of injuries by which they have been induced, the cause of death, presence of disease if any and also the collection and preservation of blood, viscera and of trace evidences found on the body or on the clothing worn by the victim. The chemical analyser may be requested to establish whether intoxication by alcohol or drugs was a factor in causing the accident and evaluation of trace evidences. The mechanical expert may be asked to examine the vehicles for any possible non-functioning part (light, brakes, and steering wheel), condition of the road and circumstances that might have played a role in the accident.

Material and Methods:
The present study was carried out in our department of forensic medicine and toxicology from January 2011 to September 2012. The material in the present study included all cases of road traffic accidents brought for medico-legal post-mortem examination. Cases satisfying the following definition of RTA and RTC were selected: RTA - A collision involving at least one vehicle in motion on a public road that results in at least one person being injured or killed. RTC - A collision or incident that may or may not lead to injury, occurring on a public road and involving at least one moving vehicle.

In all these cases detailed personal information was recorded from relatives and or accompanies of victim, police inquest papers, and hospital records. The history as regards the circumstances of the accidents and other relevant data about injuries to the victims, the site of impact was obtained from police inquest papers. Dead bodies were examined in detail during post-mortem for the presence of external injuries, internal injuries including bone and joints and finally characteristics and distribution of injuries were analysed.

All cases were thoroughly studied considering parameters like age and sex distribution, time and manner of accident, profile of victims, offending vehicles, survival period of victims, nature, type, area of the body injured, fatal injuries and cause of death. A pretested proforma was used for this purpose to extract information.
Results:

Out of 224 cases in the present study, maximum incidence of accident was in the age group of 21-30 years comprising 76 (33.92%) cases, followed by 41-50 years (19.19%).

Table 1: Age wise distribution of victims of different road users.

<table>
<thead>
<tr>
<th>Age</th>
<th>Pedestrian</th>
<th>Bicycle</th>
<th>Motor Cycle</th>
<th>Three Wheeler</th>
<th>Four Wheeler</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-10</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3 (1.33%)</td>
</tr>
<tr>
<td>11-20</td>
<td>1</td>
<td>5</td>
<td>11</td>
<td>1</td>
<td>5</td>
<td>23 (10.26%)</td>
</tr>
<tr>
<td>21-30</td>
<td>7</td>
<td>1</td>
<td>45</td>
<td>3</td>
<td>20</td>
<td>76 (33.92%)</td>
</tr>
<tr>
<td>31-40</td>
<td>9</td>
<td>1</td>
<td>20</td>
<td>0</td>
<td>5</td>
<td>35 (15.62%)</td>
</tr>
<tr>
<td>41-50</td>
<td>11</td>
<td>8</td>
<td>16</td>
<td>0</td>
<td>8</td>
<td>43 (19.19%)</td>
</tr>
<tr>
<td>51-60</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>0</td>
<td>6</td>
<td>34 (15.17%)</td>
</tr>
<tr>
<td>Above 60</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>10 (4.46%)</td>
</tr>
<tr>
<td>Total</td>
<td>46 (20.53%)</td>
<td>21 (9.37%)</td>
<td>107 (47.76%)</td>
<td>6 (2.67%)</td>
<td>44 (19.64%)</td>
<td>224 (100%)</td>
</tr>
</tbody>
</table>

Among all the road users, motorcyclists formed the majority of victims involving 107 (47.76%) cases, followed by pedestrians 46 (20.53%) cases and four wheelers 44 (19.64%) cases. In 44 four wheeler cases, 24 were using light motor vehicles like car, jeep, vans, etc and rest 20 were using heavy motor vehicles like truck, tempo, bus, tractor, etc.

Sex wise distribution of victims showed that 184 (78.26%) victims of the total were males and remaining 40 (21.74%) was females. Male to female ratio was 4.6:1.

In the present study, majority of the incidents, occurred between 1800 to 0000 hours, comprising 84 (37.50%) of total cases. Of the 84 cases occurring between 1800 to 0000 hours, 42 (50%) occurred during the first two hours.

It was observed that 89 (39.73%) victims died on the spot of accident or on their way to the hospital. After hospitalization majority of victims 83 (37.04%) died within first 24 hours. Thus 76.77% of the victims died within first 24 hours of accident.

Collision (C) between two moving vehicles (HMV,LMV, Motorcycles, Bicycle) was the commonest manner of accident involving 122 (54.46%) cases, followed by dash (D) of a vehicle to pedestrians in 46 (20.53%) and to static objects like divider, electric pole, tree, vehicle etc in 16 (7.14%) cases. Among motorcyclists skidding (S) was seen in 19 (8.48%) cases. In 11 (4.91%) cases, tumbling (T) of vehicle was the manner of accident. In 10 (4.46%) cases, victims fell (F) down from the moving vehicle.

Table 2: Victim profile and manner of accident.

<table>
<thead>
<tr>
<th>Victim profile</th>
<th>Types of offending vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HMV</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>15D</td>
</tr>
<tr>
<td>Motor-cyclists</td>
<td>33C</td>
</tr>
<tr>
<td>Bicyclists</td>
<td>11C</td>
</tr>
<tr>
<td>LMV users</td>
<td>12C</td>
</tr>
<tr>
<td>HMV users</td>
<td>9C</td>
</tr>
<tr>
<td>Three wheeler</td>
<td>1C</td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
</tr>
</tbody>
</table>

Head-on collision was reported and observed in majority (59.83%) of cases, followed by head to tail collision in 14 (11.47%) cases, head to side in 8 (6.55%) cases and side to side in 4 (3.27%) cases. In 23 (18.85%) cases the type of collision was not known.
Head injury was the most common cause of death comprising of 98(43.75%) cases, followed by Injury to vital organs 43(19.19%), Hemorrhage and shock 33(14.73%), Blunt trauma chest 17(7.58%) and Spine injury 16(7.14%). In 10(4.46%) hospitalized cases the cause of death was Septicemia due to injuries sustained. In only 1 case, an occupant of a truck died due to drowning as a result of tumbling of his vehicle into a river.

Table 3: Causes of death

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head injury</td>
<td>98</td>
<td>43.75</td>
</tr>
<tr>
<td>Spine injury</td>
<td>16</td>
<td>7.14</td>
</tr>
<tr>
<td>Blunt trauma chest</td>
<td>17</td>
<td>7.58</td>
</tr>
<tr>
<td>Blunt trauma abdomen</td>
<td>6</td>
<td>2.67</td>
</tr>
<tr>
<td>Haemorrhage and shock</td>
<td>33</td>
<td>14.73</td>
</tr>
<tr>
<td>Injury to vital organs</td>
<td>43</td>
<td>19.19</td>
</tr>
<tr>
<td>Septicemia</td>
<td>10</td>
<td>4.46</td>
</tr>
<tr>
<td>Drowning</td>
<td>1</td>
<td>0.44</td>
</tr>
<tr>
<td>Total</td>
<td>224</td>
<td>100</td>
</tr>
</tbody>
</table>

External injuries in the form of abrasions, contusions, lacerations and fractures were observed mostly on the extremities 204(91.07%) cases, head neck and face in 193(86.16%) cases, back in 88(39.28%) cases, chest in 78(34.82%) cases, abdomen in 66(29.46%) cases and pelvis in 24(10.71%) cases.

Pattern of head injury: Scalp injury in the form of contusions, lacerations was the commonest type of injury seen in 158(70.53%) cases, followed by intracranial hemorrhages 130(58.03%) and skull fractures 102(45.53%). Skull vault fracture was present in 91(40.62%) cases. Considering single region, parietal region was most commonly involved 83(23.71%), followed by frontal region 60(17.14%) and temporal region 56(16%). Linear fracture of skull was the commonest seen in 83(49.40%) cases, followed by comminuted fracture 48(30.67%) and depressed fracture in 34(20.23%) cases whereas sutural fracture was seen in 3 cases. Base of the skull was fractured in 58(25.89%) cases. Considering solitary fossa, anterior cranial fossa was fractured in majority of cases 48(13.17%), followed by middle cranial fossa 36(10.28%) and posterior cranial fossa in 28(8%) cases.

Out of 224 cases intracranial hemorrhage was seen in 130 cases of road traffic accidents. In majority 64(49.23%) of cases a combination of subdural hemorrhage and subarachnoid hemorrhage was seen, followed by only subarachnoid hemorrhage in 31(23.84%) cases and only subdural hemorrhage in 23(17.69%) cases. Thus, subarachnoid haemorrhage was the most commonly observed intracranial hemorrhage 103(45.98%) cases, followed by subdural haemorrhage 97(43.30%) and extradural hemorrhage 12(5.35%). Injury to brain in the form of contusion and laceration was found in 100(44.64%) cases; contusion of brain was present in 51 cases, laceration in 16 cases and a combination of contusion and laceration in 33 cases.

Pattern of thoracic injuries: In the present study, ribs were fractured in 82(40.59%) cases, followed by lung injury in 66(32.67%) cases. Heart was injured in 16(7.92%) cases. Fracture of ribs were observed in 82 cases out of which associated lung injury was seen in 61 cases and combination of injury to ribs, lungs and heart was seen in 12 cases. In 44(19.64%) cases thoracic injuries were associated with abdominal injuries. Amongst all the motorcyclist (107) victims, ribs and lungs were injured in 33(30.84%) and 25(23.36%) cases respectively, whereas in all (44) victims of four wheeler, ribs and lungs were injured in 25(56.81%) and 23(52.27%) cases respectively.

Pattern of abdominal injuries: Abdominal organs were injured in 68(30.35%) cases in the present study. Amongst the fatal cases of road traffic accident with abdominal injuries, liver was the most commonly injured organ seen in 25(36.76%) cases, followed by injury to liver and spleen in 16(23.52%) and injury to only spleen in 8(11.76%) cases. Considering
all 224 cases of our study, liver was the most commonly injured organ in 51(22.76%) victims followed by injury to spleen in 30(13.39%) victims.

Amongst all the motorcyclist (107) victims, abdominal organs were injured in only 26(24.30%) cases, whereas in all (44) victims of four wheeler, abdominal organs were injured in 20(45.45%) and in all (46) cases of pedestrians, abdominal organs were injured in 11(23.91%) cases.

Discussion:

The distribution of road traffic injuries in fact varies dramatically across countries or world regions, not only in terms of age or sex groupings but also in terms of road user groups and risk factors (such as speeding, alcohol-impaired driving, and not using protective devices like helmet or seatbelt). Appropriate response to disparities in types of road traffic injuries is necessary, if this major global health problem is to be comprehensively addressed.

In present study, majority of the victims (33.92%) belonged to the age group 21-30 years. Similar observations in Indian studies were noted by other authors [1,2,3]. As far as this age (21-40 years) group is considered, it is the most active phase of life, physically and socially. People in this age group are constantly mobile for work, education or recreational activities, using private or public transport for the same. Also there is tendency of this age group to show scarce attention to traffic rules & regulations and hence more prone to accidents.

We observed maximum road traffic fatalities in motorcyclists (47.76%), other researchers [4,5,6] too observed more fatalities among motorcyclists. Among all motor vehicles, motorcycles are prone for accidents as they are unstable and tumble even on slight impact. Motorcyclists are prone to injuries as they are not enclosed, leaving the riders /pillions vulnerable to contact with road surfaces.

A preponderance of male victims over females with a male: female ratio of 4.6:1 was observed in the present study. Similar findings were also observed by [5,7,8]. Higher male incidence in India can be explained by the fact that they are the working class, lead a more active life and keep themselves outdoors for most of the time. Also most of the vehicles in India are driven by males. On the contrary, females mostly keep themselves indoors doing household works.

Heavy motor vehicles like truck, bus, tempo, tanker, tractor etc were the most common offending vehicle involved in 81(48.21%) cases in our region. Our observation is in agreement with [1,9]. Impact with heavy vehicles usually has a fatal outcome due to their greater mass and velocity. The lack of discipline and traffic sense due to low education level amongst such drivers is responsible for their rash driving. Also at times they have to drive for long hours which make them tired and hence there is increase in errors made by them.

Majority of the incidents, occurred between 1800 to 0000 hours, comprising 84(37.50%) of total cases. Similarly [1,10] noted maximum incidents during evening time. In the present study maximum incidences of accidents occurring during 18:00 hours to 00:00 hours could be due to working schedule in this part; people usually come back from work being tired with the whole day’s work. Also people are in a hurry to come back home and the traffic is at peak during evening hours.

In the present study, 76.77% of the victims died within first 24 hours of accident. In accordance with our observation [9,7,10] reported maximum deaths in first 24 hours. The high incidence of deaths of victims before reaching the hospital can be attributed to the large extent of injuries, lack of effective ambulatory services and emergency units which could provide much needed first aid to the victims before reaching hospital.
Regarding the manner of accident and type of collision, we found that collision between two moving vehicles was the commonest manner of accident seen in 122(54.46%) cases, followed by dash of a vehicle to pedestrians in 46(20.53%) and to static objects like divider, electric pole, tree, vehicle etc in 16(7.14%) cases. In 11(4.91%) cases, tumbling of vehicle was the manner of accident. In 10(4.46%) cases, victims fell down from the moving vehicle. Similar observations were noted by [11,12,13].

Considering the cause of death in various road users, Head injury was the most common cause of death comprising of 98(43.75%) cases. Head injury as the cause of death in majority of cases was also observed in studies done by [1,14,15]. Extremities suffered maximum injuries 591(40.56%), followed by head, neck and face region 433(29.71%). Presence of maximum surface injuries over the extremities in our study can be due to the fact that limbs have a larger surface area and are often the first point of contact either with the offending vehicle or the surface/road.

In the present study skull fracture was observed in 45.53% of total cases. Similar finding was observed by other authors [1,16,17]. Fracture of skull vault (68%) was more commonly observed in the present study and is in accordance with studies of [2,7,9,14,16]. Parietal bone was found fractured in majority (23.71%) of cases in our study. Similar observations were made by [2,3,16]. However, Temporal bone fracture was noted in majority of cases in studies done [9,10,14] whereas Honnugar et al [18] noted frontal bone fracture in maximum cases which is in contrast with our study. In the present study linear/fissure fracture was noted in maximum (49.40%) cases. Similar observations were made by [2,3,14]. Among intracranial hemorrhages we noted a combination of subdural and subarachnoid in maximum (49.23%) cases which is in accordance with observations made by [6,19]. Considering total cases in the present study, subarachnoid haemorrhage was the most commonly observed intracranial hemorrhage 104(48.59%) cases, which coincides with the observation of [9]. Contradictory to our finding, subdural hemorrhage was observed most commonly by [1,2,3,7]. Injury to brain was observed in 44.64% cases in the present study which is in agreement with [6,15,17].

In the present study it was observed that ribs were fractured in 82(40.59%) cases. Amongst all the motorcyclist 107 victims, ribs and lungs were injured in 33(30.84%) and 25(23.36%) cases respectively, whereas in all 44 victims of four wheeler accidents, ribs and lungs were injured in 25(56.81%) and 23(52.27%) cases respectively. In accordance with our observations, [9,18,20] observed that fracture of the ribs was the commonest chest injury. Abdominal organs were injured in 68(30.35%) cases in the present study. Liver was the most commonly injured organ in 51(22.76%) victims followed by injury to spleen 30(13.39%). Amongst all the motorcyclist 107 victims, abdominal organs were injured in only 26(24.30%) cases, whereas in all 44 victims of four wheeler accidents, abdominal organs were injured in 20(45.45%). Similarly liver laceration was the commonest abdominal injury noted by [9,16,18] observed that laceration of the liver was commonly seen abdominal injury. However, in a study on pattern of thoraco-abdominal injuries by Shetty et al [20] Kidney was the most commonly involved abdominal organ followed by the liver. In another study by Govekar et al [8], most commonly injured abdominal organ noted was spleen.

Conclusion:

In the present study, involvement of young adult males to such a high extent, suggests the heavy loss of valuable man-power and human resources due to mortality and morbidity. Presence of multiple injuries in our study is in accordance with the fact that multiple injuries are a rule in road traffic accidents. The study highlights the need of compulsory implementation of helmet wearing for motorcyclist and seat belt use for four wheeler...
occupants and necessitates the need for taking urgent steps for establishing ambulance services and provision of pre-hospital care & trauma services to reduce mortality and morbidity. Use of heavy vehicles should be barred from the busy streets during evening hours and speed limits be enforced on them. Furthermore, law agencies needs to implement the traffic rules very strictly.

**Recommendations:**

Owing to the enormous impact of road traffic accidents on health and economy in our country, a multidimensional approach is suggested to minimise such incidents. They include:

1. Imparting road safety education to all persons with special emphasis on educating young persons. School children can be taught about the use of sidewalks, road crossing techniques, traffic signals, reaction time, braking distance and hazards of alcoholic drinks.
2. Issuing licenses by using comprehensive and scientifically based testing of driving skills, medical fitness “and periodic review of driving skills especially annual medical examination of drivers above 50 years of age.
3. At the time of giving license to the public transport drivers (Bus and Trucks), they can be given training in first-aid skills so that victims are attended immediately in the post accident period.
4. Speed limits should be strictly implemented near populated areas, residential areas and schools.
5. Maintaining existing roads, improving road surface, removing obstacles, constructing guards, rails, proper signs and widening or narrow sections of roads, zebra crossings for pedestrians at appropriate traffic points, building flyovers and subways wherever required to reduce traffic congestion.
6. The vehicles should be properly checked with regard to their maintenance, brakes and tyres and improving vehicle designs to minimise damage in event of a crash.
7. Citizens should change their attitudes positively, stop reckless driving, obey traffic rules, prohibit use of mobile phones while driving, and use of protective devices like helmet for two wheelers and safety seat belts in four wheelers. Attempts should be made to reduce travel and if travel is necessary public transport system should be used.
8. Trauma centres should be modernized and fully equipped with emergency drugs and surgical instruments along with adequate manpower.
9. Help line and support centres should be established in coordination with emergency response teams to prevent death/morbidity.
10. Government authorities should enforce traffic rules strictly. Breath analysers must be used regularly for testing drunken drivers and those found positive must be heftily fined with cancellation of license in cases of repetitive offence.
11. Partnerships need to be formed with public, private and non-governmental organizations to address more visibly the problems and press harder for improvements.

**Bibliography:**


