Original Article

Profile Of Road Traffic Accidents In Coastal Odisha: A Comprehensive Autopsy-Based Study

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Abstract

WHO considers accident to be an unpremeditated event resulting in recognizable damage. Worldwide the number of people killed by road traffic accident (RTA) is a whopping 1.2 million while as high as 50 million people suffer injuries from such events. The developing countries contribute heavily to this burden i.e. about 3/4th of the total fatalities of road traffic accidents. In India 11% of death resulting from non-communicable disease are due to injuries and 78% out of these are contributed by road traffic accidents.

Introduction

In direct proportion to increase in affordability and availability, the number of motor vehicle and density of vehicular traffic goes on rising day by day and this compounded by a lack of adequate road infrastructure, unsafe traffic environment, inadequate awareness of traffic rules, encroachment, attitudinal problems on part of road users, have a direct bearing on the surge in the number of accidents. In India the situation is made still worse by the unrestricted entry of cattle, dogs, cats onto the road. The ratio of road area to total area inhabited by a populace is also far behind planned cities of developed countries. The length of road available per 1000 population and so also per 100 vehicle is also gradually receding.

Every accident is likely to have several causative factors. The effect of various factors must be isolated in order to assess their importance in causation and hence in prevention. Accidents taking their toll at different places with increasing spread of road network and variation in different geographical location starting from rural to urban need a definitive demographic study. Changes in different type of road, their design, surface along with various environmental factors like lighting and visibility need a careful study.

Road conditions are important aetiological factors in RTA and have become death traps with potholes, uncompleted road project, fewer road traffic sign boards. With National Highway number 5 running in almost central and coastal Odisha, along with many other new state highways and district road, an attempt was made through this study to comprehensively analyse the road traffic fatalities in the region to analyse the pattern of injuries in relation to the mode of travel, type of injury and distribution over the body. Considering higher rates of death, the present work was planned to help the policy makers and the researchers to prevent the further death and disability.

Materials and methods

The current study was an autopsy-based study that sought to find out the various forms of road traffic accidents encountered, their epidemiological parameters, precipitating factors, circumstances, manner and causes of death

in the coastal belt of Odisha. The study was conducted from September 2014 to August 2016 in the Central Morgue Department of Forensic Medicine and Toxicology, S.C.B medical college and hospital, Cuttack with specific input from the casualty, trauma ward, department of surgery, department of orthopaedics and department of neurosurgery. For this study, all alleged fatal road traffic accident instances with documented histories describing the accident's circumstances were taken into account. Cases with absent apparent external injuries but concealed internal injuries and those with confirmed histopathological reports were included in the study. The study eliminated the cases with an unclear history, unclaimed bodies found on the road, decomposed bodies and those undergoing skeletal autopsy. Ethical clearance was taken from the Institutional Ethics Committee prior to the start of the study.

A total of 690 cases satisfying the inclusion and exclusion criteria were assessed. Case history was taken from attendants of the deceased or accompanying police personnel. Inquest report, and dead body Challan were collected in the mortuary during autopsy. The detail case history, circumstantial evidence, treatment record, laboratory investigation report and autopsy finding are analysed and compared. A pretested proforma was designed to extract information by interrogating police personnel, friends, relatives and neighbours, eye witness of the event, and others who accompanied the dead and had first-hand knowledge about the event. The dead bodies were checked for the presence of internal injuries, including broken bones and joints, as well as external wounds. Based on the nature, type, area of the body affected, and distribution of injuries, the injuries were analysed. The location of the RTA victim's death, the type of treatment they received, if any, and how long they survived after the accident were also noted. Standard procedure was followed during the autopsy, and special attention was paid to the various outward injuries, deformities, and interior anomalies that were visible on the deceased person's body.

Observations and Results

A total of 2664 autopsy were performed throughout the study period, and 690 or 26% of those that met the inclusion and exclusion criteria were included in the analysis. On average, men were five times more likely to die of RTA than women. This may be attributed to the higher degree of mobility of the male folk in the populace. The majority of the deceased were aged 30 to 60. Most victims were either motorised two-wheeler riders (38.6%) or pedestrians (30.7%). A sizable proportion was also represented by 2-wheeler pillion riders (12.0%) and pedal cyclists (7.4%). The likelihood of fatalities in a road traffic accident is lower for passengers in light or heavy vehicles.

Parameters (N=690)	**Frequency (%)**
Gender distribution	
Males	576 (83.5)
Females	114 (16.5)
Age distribution (in years)	
0-10	16 (2.3)
11-20	71 (10.3)
21-30	178 (25.8)
31-40	122 (17.7)
41-50	124 (17.9)
51-60	117 (17.0)
61-70	48 (7.0)
>70	14 (2.0)
Type of road user	
Heavy motor vehicle (tractor, max pick up) driver	1 (0.1)
Heavy motor vehicle (tractor, max pick up) occupant	4 (0.6)
Heavy transport vehicle (bus or truck) driver	8 (1.2)
Heavy transport vehicle (bus or truck) occupant	25 (3.6)
Light motor vehicle (car or jeep or SUV) driver	4 (0.6)
Light motor vehicle (car or jeep or SUV) occupant	14 (2.0)

Pedestrian	212 (30.7)
Pedal cyclist	51 (7.4)
3-wheeler occupant	16 (2.3)
3-wheeler rider	4 (0.6)
2-wheeler pillion rider	83 (12.0)
2-wheeler rider	266 (38.6)
Other	2 (0.3)

Table 1. Demographic details of the RTA victims

Table 2 depicts the timely distribution of the RTA. Due to the prolonged summers in this region of the country half of the cases of fatal RTA were observed during the summer months, reaching a peak in February (11.6%), January (11.0%), November (10.7%) and March (10.4%). Day-wise distribution revealed highest incidence of fatal RTA on a Friday (18.8%). The majority of deaths occurred immediately (45.7%) followed by 34.9% of deaths which had a survival time of 1 to 6 hours.

Parameters (N=690)	**Frequency (%)**
Month-wise distribution	
January	76 (11.0%)
February	80 (11.6%)
March	72 (10.4%)
April	42 (6.1%)
May	38 (5.5%)
June	58 (8.4%)
July	31 (4.5%)
August	52 (7.5%)
September	55 (8.0%)
October	54 (7.8%)
November	74 (10.7%)
December	58 (8.4%)
Day-wise distribution	
Monday	94 (13.6%)
Tuesday	108 (15.7%)
Wednesday	98 (14.2%)
Thursday	83 (12.0%)
Friday	130 (18.8%)
Saturday	85 (12.3%)
Sunday	92 (13.3%)
Time-wise distribution	
5AM-12PM	185 (26.8%)
12PM-7PM	293 (42.5%)
7PM-5AM	212 (30.7%)
Duration of survival after RTA	
Spot death/<1 hour	315 (45.7%)
1-6 hours	241 (34.9%)
6-12 hours	39 (5.7%)
12-24 hours	35 (5.0%)
>24 hours	60 (8.7%)

Table 2. Timely distribution of the RTA

In the majority of cases, the decedent passed away while they were driving. In some cases, the deceased were either crossing the street, walking or standing on it, or they had their vehicle parked. The most common site of injury, both fatal and non-fatal, was the lower limb (78.3%) followed by head (76%) [Table 3]. Nonetheless, the most frequent cause of death, accounting for 78% of cases, was head (including face) injuries.

Parameters (N=690)	Frequency (%)
Type of collision	
Hit from Back	263 (38.1%)
Head-on collision	173 (25.1%)
Hit a fixed object	91 (13.2%)
Hit by unknown vehicle	63 (9.1%)
Hit from side	61 (8.8%)
Animal attributed accident	21 (3.0%)
Rear-end collision	12 (1.7%)
Hit pedestrian	6 (1.0%)
Site of injury	
Head	524 (76%)
Maxillofacial	400 (58%)
Neck	80 (11.6%)
Chest	265 (38.4%)
Abdomen	270 (39.1%)
Pelvic	75 (10.9%)
Perineum	42 (6.1%)
Upper limb	495 (71.7%)
Lower limb	540 (78.3%)
Back	196 (28.4%)
Total	2887

Table 3. Type of collision and site of injury

Parameters (N=690)	Frequency (%)
Visceral injury	
Liver injury	197 (28.6%)
Contusion/laceration of lungs	172 (25%)
Contusion/laceration of brain	153 (22.1%)
Spleen injury	72 (10.4%)
Intestine loop injury	52 (7.5%)
Contusion/laceration of heart	43 (6.2%)
Contusion/laceration of spinal cord	40 (5.8%)
Kidney injury	31 (4.5%)
Bladder injury	4 (0.6%)
Bony injuries	
Skull fracture	434 (63.0%)
Fracture of leg bone	128 (18.6%)
Fracture of thigh bone	124 (18.0%)
Fracture of facial bone	122 (17.7%)
Sternum fracture	84 (12.2%)
Pelvic fracture	70 (10.1%)
Fracture of forearm bone	54 (7.8%)
Fracture of humerus bone	54 (7.8%)
Fracture dislocation of knee joint	44 (6.4%)
Fracture dislocation of hip joint	42 (6.1%)
Fracture of vertebrae-cervical	38 (5.5%)
Fracture dislocation of shoulder joint	34 (5.0%)
Fracture of vertebrae-thoracic	32 (4.6%)
Fracture of foot bone	32 (4.6%)
Fracture dislocation of ankle joint	30 (4.3%)

Fracture of vertebrae-lumbar	28 (4.1%)
Fracture dislocation of wrist joint	22 (3.2%)
Fracture of hand bone	22 (3.2%)
Fracture dislocation of elbow joint	14 (2.0%)

Table 4. Visceral and bony injuries following RTA

The liver and lungs were the two internal organs most severely impacted. Fractures and joint dislocations were observed among bone injuries, amongst which skull fracture was the most commonly encountered (63%) [Table 4]. Abrasions, contusions, lacerations, and crush injuries were also observed in addition to these severe visceral and bone injuries. Crush injuries were invariably linked to four-wheelers.

Discussion

In our autopsy based study on 690 cases of RTA deaths sparing over a period of two years we have observed that males are much more exposed to road mishaps than females. The male female ratio in the present study was found to be 4.85:1 which comes to be in between the figures that have been obtained by number of authors we have reviewed. While **Shivakumar BC et al (2010)** [27] and **Katageri S et al (2015)** [11] have found it to be 3:1 and 3.02:1 respectively. **Kumar A et al (2014)** [13] have given a male-female ratio in road traffic accident death to be 6.18:1, whereas **Rahman MZ et al (2011)** [22] and **Manusz G et al (2005)** [15] have found it to be 2.03: 1 and 1.94:1 respectively. **Pathak A et al (2004)**[21] have found a male predominance of 79.75% whereas **Madhuvardhana T et al (2015)**[14]have found a male predominance of 85.2% which gives a male-female ratio of 3.94:1 and 5.67:1 respectively which closely corresponds to the finding of Singh **Singh H et al (2010)**[29]and **Rao D et al (2010**)[23]i.e. a male-female ratio of 4.88:1 and 5.4:1 are also comparable to the present study. Unequivocally all the authors have observed a male predominance in road traffic deaths.

As regards the age of the victims of road traffic accident majority of all the authors have reported that 21- 30 years age group have been found to be most predisposed for road traffic deaths. In the present study irrespective of sex the age group 21-30 years were find to be contributing 25.8 % of the total victims whereas in male sex almost 70% of total victims belong to 16-30 and 31-45 years age group. **Shivakumar BC et al (2010)**[27] have observed a 52% two wheeler death preponderance in 31-40 years age group whereas **Katageri S et al (2015)**[11] have found a maximum representation from 31-40 age group of 25%. **Ruat A et al (2005)** [25] have found maximum number of victims in 25-44 years age group at 33.68% .**Kumar A et al (2014)** [13], **Rao D et al (2010**) [23] **,Madhuvardhana T et al (2015)** [14], **J. Chandra et al (1978)** [5], **Rahman MZ et al (2011)** [22] and **Singh PK et al (2012)** [30] have found 21-30 age group to be the maximum sufferers of road traffic accidents.

When the victims of road traffic accident were split of into different categories of road users in the present study it was found that 30.7% were pedestrian and 38.6% were on motorcycles, scooters or any other motorised two wheelers .Similar trend has been noticed in the studies by **Rao D et al (2010**)[23] (motorcyclist 41.73%), **Pathak A et al (2004)**[21] (motorcyclist 49.37% and pedestrian 32.91%), **Mehta RK, et al (2015)**[16] (motorcyclist 50 %).As per WHO India report on road traffic fatalities, riders of motorised two and three wheelers constitute 34%, passengers of cars and light vehicle contribute 10% , drivers of light vehicle contribute 7% ,pedestrians 9% and cyclist 4%. Though in our study light motor vehicle occupants and driver contribute 4.93% and 2.32 % respectively whereas bicyclist contribute 11.59%. Which is in contrast to the national data.

Similar to our study **Singh PK et al (2012)** [30], **Manusz G et al (2005)** [15], **Katageri S et al (2015)** [11] reported 37.56%, 35.8% and 25% of pedestrian victims respectively. **Shivakumar BC et al (2010)**[27]in their study have reported that out of all the traffic accident reporting to a hospital 84% were two wheeler riders and 14% were pillion riders. In our study out of all the two wheeler death 61.64% were riders and 38.36% were pillion rider which is similar to the study of **Singh H et al (2010)** [29] .The present study also reveals that 66.6% of children who were victims of road traffic accident were pedestrians though the number of deaths in the age range of 0-15 years was too less.

As regards the seasonal variation seen in road traffic accident, **Rahman MZ et al (2011)** [22] report 20.65% accidents occurring in between December to January; **Singh PK et al (2012)** [30] report 32.3 % road traffic fatalities in winter seasons. **Madhuvardhana T et al (2015)** [14] have found that 10.2 % of the total road traffic fatalities

occurred in the month of November contrary to these findings our study reveals that 57.39% of cases have occurred in the summer season, winter season contributed 27.83% of cases this can be attributed to the long summer, sparing over about 5 months i.e. (from mid-February to mid-July) in this region, whereas winter is only for 3 months (i.e. from mid-November to mid-February).

When period of survival was analysed it was found that 45.7 % (i.e. 315 out of 690 cases) died on the spot, 44.64 % have received some first aid but have died by the time they have reached a hospital. **Ruat A et al (2005)** [25] have reported that 26.32% died on the spot, 21.47% on the way to hospital and 52.21% during hospital treatment. **Shivakumar BC et al (2010)** [27] have found 38% victim to be dying on the spot where as 14% died within 1 hour, while shifting. **Supriya K et al (2015)**[31] have observed that more than 50% of victim survived up to 6 hours and few survived more than 24 hours. **Singh PK et al (2012)** [30] have found 36.10% dying at the spot and 24.41% within 1 to 6 hours.

When involvement of parts of the body were analysed in the present study, head clearly outnumbers all other body parts at 524 out of 690 cases. **Banzal RK et al (2015)** [3] have reported head injury to be the fatal outcome in 46.09% cases; **Rao D et al (2010)** [23] have found head and face involvement to be 34.64%. **Manusz G et al (2005)** [15] have reported a 31.4% head and neck related fatalities. **Singh H et al (2010)**[29] have observed that head and face involvement was seen in 84.7% of cases, lower limb 76.3%, upper limb 72.9% and also observed that 72.9% of head injuries led to fatal outcome. **Ruat A et al (2005)** [25] have found that head injury alone was seen in 29.16% cases and head along with thoraco-abdominal injuries in 13.68% cases. **Mehta RK et al (2015)**[16] in their study on road traffic accidental injuries have put forth lower extremities, upper extremities, head get involved in 27%, 25% and 19% respectively.

Whatever may be the type of road user abrasion, contusion and lacerations were the commonest external injuries come across in road traffic accidents. Similarly, irrespective of the type of offending vehicle abrasion, contusion and lacerations in decreasing order, are the predominant external injuries. Crush injuries are exclusively seen when offending vehicle is a four wheeler and fractures are encountered in descending order with heavy vehicle, light motor vehicle and motorised two wheelers as offending vehicles. As observed by **Ruat A et al (2005)** [25] crush injuries are predominantly seen in pedestrians and motorcyclists. In the present study, pelvis and limb injuries are invariably seen in pedestrian, bicyclists and motorised two wheeler riders.

Some form of skull bone fracture was noticed in almost half the cases where there was some external injury to the head. Sub Dural haemorrhage and intracerebral haemorrhage were by far the most common type of intracranial haemorrhage seen in head injuries due to road traffic accidents.