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Original Article

Road Traffic Fatalities in coastal Odisha: Autopsy based study

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Abstract:

Background: With man's invention of the wheel, the death knell has continued to toll for many. Death and deformity resulting from the accident has become a common occurrence in the society all over the world and road traffic accident outnumbers the other sources of accidental deaths. WHO considers accident to be an unpremeditated event resulting in recognizable damage.
Objective: To study road traffic fatalities and associated factors
Methods: The study title "Profile of Road Traffic Fatalities in Coastal Odisha: Autopsy Based Study" seeks to find out not only the various forms of road traffic fatalities and epidemiological parameters but also points out precipitating factors, circumstances, manner and causes of death in the coastal belt of Odisha.
Results: It was noticed that while pedestrian and two wheeler riders accounted for the bulk of the victims, four wheeler make for the majority of offending vehicle. Whereas when the victim is a four wheeler driver or occupant, invariably the offending vehicle is a heavy vehicle. No limb injuries could be seen in four wheeler driver or occupants and only 2 cases of fatal pelvic injuries were detected in light motor vehicle drivers. Abrasions and contusions were the injuries predominantly seen in all type of road users, closely followed by lacerations. The overall representation of injury to lungs/pneumothorax/hemothorax though is 5.22% (i.e. 36 out of 690 cases), but when it comes to occupants of four wheelers it is seen in 12 out of 52 cases (i.e.23.08%). It was seen that bulk of the death due to cranio-cerebral injuries has occurred within few hours to few days i.e. within a week. Out of the total 418 cases of death due to cranio-cerebral injuries, in 294 cases fracture of some form or other were noticed.
Conclusion: Despite the limitations, the study could put some light on parameters multifarious factors leading to road traffic accidents deaths. Cause of motor vehicle accident crashes and road accidents are multifactorial and the pre-crash factors include people, vehicles and road environment. In developing countries human error accounts for majority of the accidents.
Key words: Accidents, death, event

Introduction:

With man's invention of the wheel, the death knell has continued to toll for many. Death and deformity resulting from the accident has become a common occurrence in the society all over the world and road traffic accident outnumbers the other sources of accidental deaths. WHO considers accident to be an unpremeditated event resulting in recognizable damage. The same has also been reiterated by the American society council, which is of the view that accident denotes occurrence of a sequence of events which usually ends in unintended injury, death or damage of property. There were 169107 cases of road traffic accidents in year 2014 accounts for maximum share i.e. 37.4% of unnatural death from accidents in India. In 2014 as per **NCRB** [1] data there was 13.6 road traffic accident death per 1 lakh population. In India for each 1000 vehicle there occurs an average 7.5 accidents. As per NCRB data in Asian countries maximum cases have been reported between 15:00 - 18:00 hours and 60-80% of road traffic accident occurs in urban and semi urban area. NCRB 2014 reveals that a total of 4,50,898 vehicular accidents to have resulted in 1,41,526 death and 51 cases of road traffic accident took place every one hour during 2014, wherein 16 person were killed. Death due to road accidents in the country have increased by 2.9% during 2014 (141526) over 2013 (137423).

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 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 accident. In India the situation is made still worse by the unrestricted entry of lower animals into the road. The ratio of road area to total area inhabited by a vehicle population is also far behind planned cities of developed countries .The length of road available per 1000 population and so also per 100 vehicles is also gradually receding. It is an essential first step in road traffic accident prevention to obtain reliable epidemiological

information. Adequate and accurate data provide the only satisfactory means of studying accident trends.

The essential factors in RTA include the person, the machine and the roads. Accidents are taking their toll at different places, with increasing spread of road network and variation in different geographical location starting from rural to urban. Changes in different type of road, their design, surface along with various environmental factors like lighting and visibility need a careful study. Power, styling, aerodynamics of different types of vehicle available in this modern civilization along with their safety features are to be correlated with their nature of impact in an accident. A linkage between type of road, type of vehicle, safety measures adopted and fatalities need to be calculated.

High standard emergency management and surgical care and an organized team work by many disciplines such as traffic police, law and enforcement officers, mobile ambulance service, civil engineers, use of safety measures like helmet, seatbelt, airbag, verification of fitness standards of vehicle etc., can arrest the rise in incidence as well as prevent fatalities. 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-16 almost running in central and coastal Odisha along with many other new State highway and District road, an attempt is being made through this study to comprehensively analyse the road traffic fatalities in the region.

Our aim in the study is

1. To have an overview of fatal injuries arising out of road traffic accident
2. To assess the severity of the injuries ,the preparedness in treatment & period of survival
3. To correlate fatal injuries sustained with type of vehicle involved.
4. Comparative study of all the data thus obtained, to highlight the causes leading to the steady increase in road traffic accidents.
5. To devise a protocol for prompt multipronged approaches to road accident victims.
6. To find the relationship between different type of road users and their external and internal injuries found on them
7. To compare different type of offending vehicle and resultant gravity of various injuries.
8. To interpret different type of causes of death found in different type of road user victims.

Methods:

The study title "Profile of Road Traffic Fatalities in Coastal Odisha: Autopsy Based Study" seeks to find out not only the various forms of road traffic fatalities and epidemiological parameters but also points out precipitating factors, circumstances, manner and causes of death in the coastal belt of Odisha. Keeping this in view, literature and methods of different workers are followed. The details of procedure followed are described below.

STUDY DESIGN: This is conducted at S. C. B. medical college and hospital, Cuttack during the period of September 2014 to August 2016. In this study all alleged Road Traffic Accident cases brought for medico legal autopsy to mortuary of S. C. B. medical college are taken into consideration. Case history is taken from relative of deceased, accompanying police personal, inquest report, and dead body Challan in the mortuary during autopsy. The detail case history, circumstantial evidence, treatment record, laboratory investigation report and autopsy finding are analysed and compared. It is a prospective open level controlled study.

SETTING: Central Morgue Department of Forensic Medicine and Toxicology, S. C. B. medical college and hospital, Cuttack. With specific input from the casualty, trauma ward, dept. of surgery, dept. of orthopaedics and department of neurosurgery.

INCLUSION CRITERIA:

- All case of alleged fatal Road Traffic Accident having a definite history regarding the circumstances of the accident has been considered for this study.
- Concealed injuries of the internal organs in spite of absence of visible external injuries are also included.
- The organs and structures having pathological lesions which are involved due to Road traffic Accidents are included.

EXCLUSION CRITERIA:

- Alleged cases of road traffic accidents without any clear history are excluded from the study.
- Unclaimed bodies found on the road with multiple injuries and high suspicion of the road traffic accidents are excluded from the study
- Decomposed bodies in which organs are liquefied are also excluded from the study
- Skeletal autopsy are not included in the study.

STUDY POPULATION: A total of 690 cases are assessed out of all the cases within the 2 years of study, based on inclusion and exclusion criteria cited above.

STUDY MATERIAL: The materials for present study include following information and relevant

- History given by accompanying persons/relative and police by asking questions in both questioner and interrogative method
- Inquest report, dead body Challan, case report, and relevant police documents
- Bed head ticket from hospital (if available)
- Format followed during post mortem examination
- Dead body of deceased
- Laboratory reports (if available)

A pretested pro-forma specially designed for this purpose was needed to extract information by interrogating police personnel accompanying the victim as well as friends, relatives and neighbours, eye witness of accident, and other who accompanied victim and had first-hand knowledge about the event.

All 690 dead bodies were examined in depth at post-mortem for the presence of external injuries, internal injuries including bones and joints and finally characteristics of injuries were analysed regarding their nature, type, area of the body injured and distribution of injuries. Additionally place of death of RTA victim, nature of treatment provided if any, and period of survival following accidents were also recorded.

After a careful and thorough autopsy, all the above data recorded and post-mortem finding are documented in the same pro-forma. Thorough external examination of the body with wearing clothes, observing the various stains like mud, dust, blood, grease along with broken glasses etc. and so on are recorded at the beginning. After removing the clothes and cleaning the body, external injuries on the body are recorded in relation to the exact site on the body and their height from heel and other bony prominences. During the autopsy, standard technique has been followed with special attention to the different types of external injuries, deformity and internal abnormalities present over the body of deceased person.

Results & Discussion:

When the type of road user/victim was compared against the type of offending vehicle [Table-1] it was noticed that while pedestrian and two wheeler riders accounted for the bulk of the victims, four wheeler make for the majority of offending vehicle (424 out of 690 i.e. 61.45%). Two wheelers are the offending vehicle in 24.64% cases. In every case where a pedestrian or bicyclist is the victim, invariably an offending vehicle is involved. Whereas when the victim is a four wheeler driver or occupant, invariably the offending vehicle is a heavy vehicle. In 14 out of 50 cases i.e. 28% people travelling in light motor vehicle have faced outcome without involvement of any other vehicle, whereas for heavy vehicle such events were seen in 4 out of 22 cases (i.e. 18.18 %). Similar trend has been noticed in the studies by Rao D et al [2] (motorcyclist 41.73%), Pathak A et al [3] (motorcyclist 49.37% and pedestrian 32.91%), Mehta RK et al [4] (motorcyclist 50 %). As per WHO India [5] 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 [6], Manusz G et al [7], Katageri S et al [8] reported 37.56%, 35.8% and 25% of pedestrian victims respectively. Shiva Kumar BC et al [9] 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. [10]

When the distribution of fatal internal injuries were assessed as per the type of road users [Table- 2], no limb injuries could be seen in four wheeler driver or occupants and only 2 cases of fatal pelvic injuries were detected in light motor vehicle drivers. Bulk of the cases i.e. 64.35% had fatal injury to the head, that too predominantly contributed by pedestrian. Out of all pedestrian victims 65.14% succumbed to head injuries. Similarly for bicyclist it was 57.5%, two wheeler riders (64.28%), pillion riders (80.33%). The incidence of fatal injury in the neck was only 38 (5.5%) out of 690 cases, where as it was mostly seen in light motor vehicles i.e. 12 (24%) out of 50 cases. Chest and abdomen injuries were more or less seen equally in all type of road users i.e. 18.35% in pedestrian, 25% in bicyclist, 21.43% in two wheeler riders, 28% in light motor vehicle, whereas it was 33.33% in heavy vehicle occupants and all the 6 cases of heavy vehicle drivers had received fatal abdomen injuries. Banzal RK et al [11] have reported head injury to be the fatal outcome in 46.09% cases; Rao D et al [7] have found head and face involvement to be 34.64%. Manusz G et al [7] have reported a 31.4% head and neck related fatalities. Singh H et al [10] 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 [12] 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 [4] in their study on road traffic accidental injuries have put forth lower extremities, upper extremities and head got involved in 27%, 25% and 19% respectively.

Examining the external injuries [Table-3], abrasions and contusions were the injuries predominantly seen in all type of road users, closely followed by lacerations. Grazed abrasion which is a characteristic of road traffic accident was most predominantly seen in case of two wheeler riders (37.75 %). Crush injuries were not seen in light motor vehicle driver and rear seat occupant as well as in heavy vehicle driver but in light motor vehicle front occupant it was 33.3%. Similarly fracture was also common in light motor vehicle front occupant 77.77%. 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 [12] 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.

As depicted in table 4,438 cases i.e. 63.48% died due to injury to head. Fatal injuries to chest or abdomen were similarly represented with 70 and 78 cases respectively, however only 50% had fatal injury solely to chest or abdomen. When the fatal injuries are located in the neck or pelvis or limbs they are associated with the least number of fatal injuries on other parts of the body.

Cranio-cerebral injury accounts for the majority (60.58%) of deaths in road traffic accidents followed by shock and haemorrhage (15.22%), spinal injury was responsible for causing death in 37.5% of light motor vehicle drivers and 22.22% of front seat occupants [Table 4]. The overall representation of injury to lungs/pneumothorax/hemothorax though is 5.22% (i.e. 36 out of 690 cases), but when it comes to occupants of four wheelers it is seen in 12 out of 52 cases (i.e. 23.08%). Out of all the instantaneous deaths encountered due to excessive deformities, crushings, amputating decapitation, a sizeable 45% were seen in two wheeler drivers. Septicaemia was found to be causing death only in 5.22 % of the total cases studied whereas peritonitis was the cause of death in 1.88% cases. Only 6 cases of death due to fat embolism have been encountered which were exclusively

seen in pedestrian and two wheeler riders. As regards the cause of death, Singh PK et al [6] have reported that shock and haemorrhage was the cause in 36.64% cases whereas injury to brain was seen in 30.73% cases. Intracranial haemorrhage was the cause of death in 18.54% of cases. Dileep KR et al [13] have observed that cranio-cerebral injuries to be the cause in 63.5% cases, shock and haemorrhage in 26.9% and septicaemia in 6.47% of cases. As per the study of Banzal RK et al [11] head injury was the most common (46.09%) injury in road traffic fatalities whereas injury to face was seen in 22.69% victims. Both taken together resemble the present study.

When cause of death was compared with the survival time [Table 5] it was seen that bulk of the death due to cranio-cerebral injuries has occurred within few hours to few days i.e. within a week. On the contrary 77.8% of the death due to spinal injuries has taken place after 2 days of the incident extending up to months. 98 out of 105 cases i.e. 93.33% cases of death due to shock and haemorrhage have occurred within the first few hours. Death due to injuries and complications in the thoracic cavity has either occurred within the first hour or in the subsequent days up to a week. Ruat A et al [12] have reported that 26.32% died on the spot, 21.47% on the way to hospital and 52.21% during hospital treatment. Shiva Kumar BC et al [9] have found 38% victim to be dying on the spot where as 14% died within 1 hour, while shifting. Supriya K et al [14] have observed that more than 50% of victim survived up to 6 hours and few survived more than 24 hours. Singh PK et al [6] have found 36.10% dying at the spot and 24.41% within 1 to 6 hours.

Table 6 depicts the relationship between fracture of skull and intracranial haemorrhage and injuries. Out of the total 418 cases of death due to cranio-cerebral injuries, in 294 cases fracture of some form or other were noticed. In 105 cases only fissure fracture was noticed, in 28 cases only depressed comminute fracture was noticed, 47 cases were of isolated basal fracture of skull, 108 cases had combination of either fissure, depressed or basal fracture or all three together with or without sutural separation at times. In 6 cases there was gross deformity of the cranium. Contusion and laceration of brain were found independent of fracture of skull. In 64 cases extra-dural haemorrhage was seen, subdural haemorrhage in 266 cases, subarachnoid haemorrhage seen in 158 cases and intra-cerebral haemorrhage seen in 392 cases. Extradural haemorrhage was seen in 60 cases out of the 294 cases of skull fracture, whereas amongst 124 cases where there was no fracture, only 4 case of extra-dural haemorrhage were seen. Subdural haemorrhage was seen in 206 out of 294 (70.07%) cases of cranio-cerebral injuries, whereas subdural haemorrhage was seen in 60 cases out of 124 cases (48.39%) where skull is intact. Sub arachnoid haemorrhage and intra-cerebral haemorrhage did not show any relation with presence or absence of skull fracture. Banzal RK et al [11] have also studied different types of injuries in the head and have observed that contusions were seen in 84.74% cases and laceration of scalp in 42.90%. They have detected skull fractures in 69.14% whereas intracranial haemorrhage was seen in 78% cases. They have also found contusion and laceration of brain in 52.83% of cases and cerebral necrosis in 42.13%. These figures to some extent resemble the findings of the present study.

Conclusion:

Despite the limitations, the study could put some light on parameters multifarious factors leading to road traffic accidents deaths. Cause of motor vehicle accident crashes and road accidents are multifactorial and the pre-crash factors include people, vehicles and road environment .In developing countries human error accounts for majority of the accidents. A high prevalence of old vehicles on the roads, vehicles carrying people in excess of what they are designed for, lack of use of safety belts and helmets, poor road deign, congestion of roads, encroachments, over speeding, poor maintenance, mixing of variety of traffic are few factor other than human error which lead to the rise in rate of road traffic accidents in the less developed countries.

Apart from measure to improve the road environment, increase the traffic awareness among the public and use of available safety measure, a realistic mechanism to move the victims to well-equipped trauma centre as soon as possible may help towards curbing the incidence of road traffic fatalities.

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Table 1: Relationship between type of road user and offending vehicle

Type of road user	Heavy vehicle (hv)	Light motor vehicle(lmv)	Motorcycle (mc)	Fall down as such (f)	Total
Pedestrian(p)	62	68	88	-	218
Bicyclist(b)	28	24	28	-	80
Motorcycle rider(r)	76	68	24	28	196
Pillion rider(pl)	18	24	30	50	122
Light motor vehicle driver(ld)	10	-	-	6	16
Light motor vehicle front occupant(lf)	16	-	-	2	18
Light motor vehicle rear occupant(lr)	8	2	-	6	16
Heavy vehicle occupant(ho)	16	-	-	2	6
Heavy vehicle driver(hd)	4	-	-	2	18
Total	238	186	170	96	690

Table 2: Type of victim involved in relation to internal injury disributed over body

Type of road user	Head	Neck	Chest	Abdomen	Pelvis	Limbs	Total
Pedestrian(p)	142	2	12	28	18	16	218
Bicyclist(b)	46	4	14	6	4	6	80
Motorcycle rider(r)	126	16	20	22	2	10	196
Pillion rider(pl)	98	2	8	4	6	4	122
Light motor vehicle driver(ld)	6	4	-	4	2	-	16
Light motor vehicle driver(ld)	8	6	2	2	-	-	18
Light motor vehicle rear occupant(lr)	8	2	-	6	-	-	16
Heavy vehicle occupant(ho)	10	2	4	2	-	-	18
Heavy vehicle driver(hd)	-	-	-	6	-	-	6
Total	444	38	60	80	32	36	690

Table 3: Comparison between the type of road user victims and external injuries on the body

Type of road user	Abrasion	Contusion	Laceration	Fracture	Crush	Graze	Burn
Pedestrian(p)	190	178	116	58	18	50	-
Bicyclist(b)	74	62	50	22	4	20	-
Motorcycle rider(r)	182	166	150	60	14	74	4
Pillion rider(pl)	106	94	70	12	8	22	-
Light motor vehicle driver(ld)	16	12	12	2	-	4	-
Light motor vehicle occupant(lf)	14	10	16	14	6	2	-
Light motor vehicle rear occupant(lr)	14	14	4	6	-	2	-
Heavy vehicle occupant(ho)	4	2	4	2	-	-	-
Heavy vehicle driver(hd)	16	14	18	6	2	2	-

Table 4: Relationship between type of road user/ victims and cause of death

TYPE / CAUSE OF DEATH	CRANIOCEREBRAL INJURY (CI)	SHOCK AND HAEMORRHAGE (SH)	SEPTICAEMIA (SM)	SPNAL INJURY (SI)	FAT EMBOILISM (FE)	INSTANTENIOUS (I)	PNEUMOTHORAX (LI)	PERITONITIS (PT)	TOTAL
Pedestrian (p)	136	49	16	2	4	6	2	3	218
Bicyclist(b)	48	12	6	4	-	6	3	1	80
Motorcycle rider(r)	112	24	8	16	2	18	13	3	196
Pillion rider(pl)	98	9	2	2	-	5	6	-	122
Light motor vehicle driver(ld)	6	3	-	6	-	-	-	1	16
Light motor vehicle driver(ld)	2	3	-	4	-	3	4	2	18
Light motor vehicle rear occupant(lr)	8	1	2	2	-	-	3	-	16
Heavy vehicle occupant(ho)	8	4	-	-	-	-	5	1	18
Heavy vehicle driver (hd)	-	-	2	-	-	2	-	2	6
Total	418	105	36	36	6	40	36	13	690

Table 5: Relationship between cause of death in victims and survival time

Survival time / Cause of death	<1 hour	Within 6-8 hours	Within 1-2 days	Within 1 week	Weeks To Months	Total
Craniocerebral (ci)	16	100	72	180	50	418
Shock and Haemorrhage(sh)	30	68	7	-	-	105
Spinal Injury(si)	4	2	2	14	14	36
Septicaemia (sm)	-	-	-	18	18	36
Fat Emboilism(fe)	-	-	-	6	-	6
Instantaneous Death(i)	40	-	-	-	-	40
Lung injury (li) (pneumothorx,haemothorax)	18	-	12	6	-	36
Peritonitis (pt)	-	-	-	9	4	13
Total	108	170	93	233	86	690

Table 6: Relationship of skull fractures and intracranial haemorrhage in death due to cranio cerebral injuries

TYPE OF FRACTURE / INTRA CRANIAL FINDINGS	FISSURE FRACTURE (n=105)	DEPRESSED COMMINUTED FRACTURE (n=28)	GROSS DEFORMITY OF SKULL (n=6)	BASE OF SKULL FRACTURE (n=47)	BASE FRACTURE ALONG WITH FISSURE/COMMINUTED FRACTURE (n=108)	NO FRACTURE (n=124)
Contusion	96	26	-	44	104	114
Laceration	68	20	-	36	76	62
Extra dural haemorrhage	22	3	-	5	30	4
Sub dural haemorrhage	72	20	-	44	70	60
Sub arachnoid haemorrhage	38	6	-	24	48	42
Intra cerebral haemorrhage (brain stem haemorrhage)	98	25	-	44	106	119
Gross contusion,laceration expulsion of brain matter	-	-	6	-	-	-

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