
Original article

An epidemiological study on pattern of thoraco-abdominal injuries sustained in fatal road traffic accidents of Bangalore: Autopsy Based Study

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Abstract

Background: The statistical profile reflects a global estimate of 5.1 million deaths in 2000, which was due to injuries due to fatal RTA. This accounted for 10% of deaths due to all causes. Out of this a quarter of injury-related deaths occurred in the South-East Asian region. Road Traffic Accident (RTA) is one among the top five causes of morbidity and mortality in South-East Asian countries. Most common cause of blunt abdominal trauma in India is road traffic accident followed by pedestrian accidents, abdominal blows and fall from heights.

Aims: To analyze the epidemiology and pattern of fatal thoraco-abdominal Injuries in road traffic accidents

Methodology: An autopsy based Cross sectional study conducted. A purposive sampling technique was applied to select the study sample of 100 post mortems of Road Traffic Accident between November 2008 and May 2010 subjected to medico-legal autopsy at the department of Forensic Medicine, KIMS Hospital Bangalore.

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Results: The majority of the victims were aged 21 to 40 years 50 (50.0%), most of the victims were male 92 (92.0%), and male/female ratio 11.5:1. Commonest offending agents in were heavy motor vehicles 54 (54.0%). Bony cage sustained injuries were observed in 71 out of this fractures of ribs were observed in 45 (63.3%) victims, clavicle in 14 (19.7%), sternum was 6 (8.4%), and vertebrae 6 (8.4%) of fatal road traffic accidents. Internal thoracic injuries were observed in 26 cases. Among internal thoracic injuries, lungs were the most commonly involved organ 24 (92.3%) followed by the heart 2 (7.6%). Lung sustained more lacerations 19 (79.1%) than contusions 5 (20.8%). Internal abdominal injuries were observed in 49 cases. In road traffic accidents the most commonly injured abdominal organs were solid organs such as Liver 16 (32.6%) followed Spleen 9 (18.3%).

Conclusions: Road traffic accidents commonly involved young and productive males. More than fifty per cent of the accidents were found to occur during the weekends. Most common cause of death in RTA was Head injury followed by persistent irreversible shock. Hospitals with designated trauma centers have improved outcomes when compared to hospitals without them, and if trauma victims transfer directly to a trauma centre it can greatly improve the outcome of the trauma case. This study can help the planners to take safety measures, to risk stratification in the susceptible population and the study of nature of offending agent in RTA can help the authorities in propagating safety

measures to educate the people and to create better health care facilities (Trauma centers, quick response teams and Ambulances) on roads.

Key Words:

Road Traffic Accidents, Abdominal injuries, Thoracic injuries, Bangalore

Introduction:

Accidents are considered as a modern day epidemic and counter product of modernization and hasty life. The statistical profile reflects a global estimate of 5.1 million deaths in 2000. Road Traffic Accident (RTA) accounted one of the top five causes of morbidity and 10% -25% of mortality in South-East Asian countries.^{1, 2} RTA cause mechanical trauma, resulting in morbidity, disability and even mortality. India is one of the highest victimized by road traffic accidents in the world and reported to be 20 times more than that reported in developed countries.³ Narrow and defective roads were the major cause for RTA. The World Health Organization (WHO) in its international conference on RTA noted the importance of adequate data on traffic injuries. The abdomen is the third common region of the body that is injured in civilian trauma.⁴ Blunt abdominal trauma (BAT) is the main cause of death in people under 35 years of age in worldwide among trauma victims.⁵ In India RTA is the most common cause of blunt abdominal trauma followed by pedestrian accidents, abdominal blows and fall from heights. This ever expanding epidemic targeting the young and productive

generations is likely to take a heavy burden on the quality of life and socioeconomic growth of the region.⁶ People who have suffered trauma may require specialized care, including surgery and blood transfusion for successful outcomes, this emergency care has to respond as quickly as possible during the golden hour of trauma to save the valuable lives.

Methodology:

An autopsy based Cross sectional study conducted in correlation with the relevant clinical records and the reports from investigating agencies was conducted. A purposive sampling technique was applied to select the study sample of 100 Road Traffic Accident victims, subjected to medico-legal autopsy in the department of Forensic Medicine, tertiary care KIMS Hospital Bangalore, India between November 2008 and May 2010. RTA was defined as an accident which took place on the road between two or more objects, one of which must be any kind of a moving vehicle. The data were compiled with a focus on the analysis of injuries in the thoraco-abdominal region with special reference to the nature of the wound, and organs most commonly affected in road traffic accidents and epidemiological factors in relation to victims, vehicles and sites of impacts, and their survival period .etc. Besides, features pertaining to hosts (road users), the agents (vehicles) and the environmental condition (road, seasons, time etc). Autopsies with an alleged history of RTA were included in the study and other autopsies which were not had any history

of RTA (Suicides, Homicide and other accidental deaths like drowning and burns etc.) were excluded from the study

Results:

The majority of the victims were aged between 21 to 40 years 50 (50.0%), most of the victims were male 92 (92.0%), and with 11:1 male/female ratio. More crashes 37 (37.0%) took place between 6:00 PM to 12:00 PM on weekends 55 (55.0%) at city roads 70 (70.0%). Details of RTA victims their epidemiology has been provided in table 1. Two wheeler occupants were the most common victims of road traffic accidents 52 (52.0%) followed by pedestrians/bicycle 38 (38.0%), and Light Motor Vehicle (LMV) 8 (8.0%). Most common injuries observed in RTA were 73 (73%) External thoracic injuries, followed by 49 (49%) abdominal injuries, 47 (47%) Head injuries, 46 (46%) extremities (Upper limb 33 and Lower limb 13), 7(7%) vertebra, 5(5%) pelvis and 4(4%) spinal cord injuries among the victims. External abdominal injuries noticed among 44% of cases. Most common type of injury was contusion 21 (47.7%) followed by abrasion 16 (36.3%), laceration 5 (11.3%) and incised wounds 2 (4.5%). Internal abdominal injuries were observed in 49 cases. In road traffic accidents the most commonly injured abdominal solid organs were liver 16 (32.6%) followed by spleen 9 (18.3%). Among the abdominal injuries sustained in road traffic accidents, the Liver and spleen injured more lacerations than contusions where as in the kidney contusion was the

common. Details of Abdomino-pelvic injuries have been given in Table 2.

External injuries to the thorax were more frequent than internal injuries while in the abdomen internal injuries was observed more frequently than external injuries. External thoracic injuries were observed in 73 cases; commonest was contusion 39 (53.4%) followed by abrasions 28 (38.3%), lacerations 7 (9.5%) and incised wounds 1(1.3%). Thoracic bony cage sustained injuries 71 among 100 fatal road traffic accidents. Out of this 71; fracture ribs 45 (63.3%), clavicle 14 (19.7%), sternum 6 (8.4%), and vertebrae 6 (8.4%). Internal thoracic injuries were observed in 26 cases. Among internal thoracic injuries, lungs were the most commonly involved organ 24 (92.3%) followed by the heart 2 (7.6%). Lung sustained more lacerations 19 (79.1%) than contusions 5 (20.8%).

The most common cause of death in RTA was head injury 47 (47.0%) second common cause of death was persistent irreversible shock 42 (42.0%) and in considerable number of cases septicaemia 11 (11.0%) was the cause of death. Survival time in detail has shown in table 3. Commonest offending agents were heavy motor vehicle 54 (54.0%). Light motor vehicle 24 (24%), two wheeler 12 (12.0%) remained 10(10%) unknown (hit and run). Fracture extremities details have been provided in table 4.

Table 1 - Distribution of RTA victims based on Epidemiology and sex n= 100

| Category | Male | Female | Total |
|--------------------------|-------------------|-----------------|---------------------|
| Age in years | | | |
| <20 | 14 (14.0%) | 1 (1.0%) | 15(15.0%) |
| 21–40 | 46 (46.0%) | 4 (4.0%) | 50(50.0%) |
| 41–60 | 27 (27.0%) | 3 (3.0%) | 30(30.0%) |
| ≥61 | 5 (5.0%) | 0 (0.00%) | 5(5.0%) |
| Total | 92 (92.0%) | 8 (8.0%) | 100 (100.0%) |
| Time of day | | | |
| 12 am–5:59 am | 6 (6.0%) | 1 (1.0%) | 7(7.0%) |
| 6 am–11:59 am | 22 (22.0%) | 2 (2.0%) | 24(24.0%) |
| 12 pm–5:59 pm | 29 (29.0%) | 3 (3.0%) | 32(32.0%) |
| 6 pm–11:59 pm | 35 (35.0%) | 2 (2.0%) | 37(37.0%) |
| Total | 92 (92.0%) | 8 (8.0%) | 100 (100.0%) |
| Place of accident | | | |
| National High way | 5 (5.0%) | 3 (3.0%) | 8 (8.0%) |
| State High way | 20 (20.0%) | 2(2.0%) | 22 (22.0%) |
| City roads | 67 (67.0%) | 3(3.0%) | 70 (70.0%) |
| Total | 92 (92.0%) | 8 (8.0%) | 100 (100.0%) |

Table 2 Distribution of RTA victims based on type of Abdomino-pelvic injury

| Type of organ injured | Male | | Female | | Total | |
|-------------------------|-----------|----------------|----------|----------------|-----------|----------------|
| | Number | Percentage | Number | Percentage | Number | Percentage |
| Liver laceration | 14 | 32.56% | 2 | 33.33% | 16 | 32.65% |
| Spleen laceration | 8 | 18.60% | 1 | 16.67% | 9 | 18.37% |
| Kidney laceration | 5 | 11.63% | 1 | 16.67% | 6 | 12.24% |
| Stomach rupture | 2 | 4.65% | 0 | 0.00% | 2 | 4.08% |
| Pelvis # | 4 | 9.30% | 1 | 16.67% | 5 | 10.20% |
| Vertebra # | 6 | 13.95% | 1 | 16.67% | 7 | 14.29% |
| Spinal cord transection | 4 | 9.30% | 0 | 0.00% | 4 | 8.16% |
| Total | 43 | 100.00% | 6 | 100.00% | 49 | 100.00% |

Table 3 Showing period of survival following accident and site of initial impact of the responsible vehicle

| Period of survival | Type of Vehicle Used | | | | Total |
|--|----------------------|-----------|-----------|-------------|------------|
| | Two wheeler | LMV | HMV | Pedestrians | |
| Spot death | 9 (17.3%) | 3 (37.5%) | 1 (50.0%) | 7 (18.4%) | 20 (20.0%) |
| Died within 24 hours | 19 (36.5%) | 2 (25.0%) | 0 (0.0%) | 18 (47.3%) | 39 (39.0%) |
| Survived beyond 24 hours but within 7 days | 9 (17.3%) | 1 (12.5%) | 1 (50.0%) | 7 (18.4%) | 18 (18.0%) |
| Survived beyond 7 days but within 21 days | 15 (28.8%) | 2 (25.0%) | 0 (0.0%) | 6 (15.7%) | 23 (23.0%) |
| Total | 52 (100%) | 8 (100%) | 2 (100%) | 38 (100%) | 100 (100%) |

Table 4: Type of Fracture extremities among RTA

| Type of Fracture | Left | | Right | |
|------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Femur | 5 | 16.67% | 1 | 6.25% |
| Tibia | 3 | 10.00% | 1 | 6.25% |
| Fibula | 2 | 6.67% | 1 | 6.25% |
| Humerus | 6 | 20.00% | 4 | 25.00% |
| Radius | 2 | 6.67% | 2 | 12.50% |
| Ulna | 3 | 10.00% | 2 | 12.50% |
| Clavicle | 9 | 30.00% | 5 | 31.25% |
| Total | 30 | 100.00% | 16 | 100.00% |

Discussion

This study found that majority of the Road Traffic Accident (RTA) victims were aged between 21 to 40 years 50.0%. Similar studies conducted by Chaudhary et al^[7] and SureshKumar^[8] found that 51.2% and 83% respectively were aged between 21 to 40 years. Most of the victims were males 92.0%. Agnihotri et al^[9] and Khajuria et al^[10] studies also observed the same. (80.58% and 85.14% respectively).

Present study found 37.0% of the RTA occurred in between 6:00 PM to 12:00 PM, and 55.0% took place on weekends. Kimberly et al also argued the same,^[11] but Khajuria et al reported 54.22% RTAs occurred during the daytime, between 9 AM to 8 PM.^[10]

Research has shown that the two wheeler occupants are commonly affected in RTA.^[12] In our study most of the victims who sustained thoraco-abdominal injuries in the road traffic crashes 52% (riders 38% and pillion riders 14%) were two wheeler occupants followed by pedestrians 38% and LMVs 8%. Our findings in this regard correlate well with the earlier studies of Chaudhary et al^[7] and SureshKumar et al.^[8] But Archana et al observed maximum number of fatalities among pedestrians 35.79% followed by motorized two wheelers (motor cyclist scooterist etc) 30.5% and lowest incidence have been noted among pedal cyclists (5.47%).^[13] Motor cyclist/scooterists were the most commonly involved group in fatal RTAs, reason being careless speed driving, thrill seeking, overtaking and less stability of the vehicle. Besides, these vehicles are mostly used by 15-50 years age group.

External thoracic injuries were most common injuries (73%) among RTA victims, followed by abdominal injuries 49%, head injuries 47%, upper limb 33% and lower limb 13%, vertebra 7%, pelvis 5% and in spinal cord 4% of the victims. Our observations were contradicted by Jha N et al study finds head injuries was the commonest 34.1% followed by lower limbs

13.7%, and face 10.7%.^[14] Khajuria et al reported limb injuries (31%) were commonest followed by head (28), thorax 18%, abdomen 17%, pelvis 3% and spine 0.8%.^[10]

External thoracic injuries were observed in 73% of cases. Contusion was the common type 53.4% followed by abrasions 38.3% and lacerations 9.5%. External abdominal injuries occurred in 44% of cases, among this contusion was common type of injury 47.7% followed by abrasion 36.3%, and laceration 11.3%. Similar findings were observed by Jha N et al,^[14] SureshKumar et al.^[8] Bony cage sustained injuries observed in 71% of the victims; fracture ribs 63.3%, 19.7% clavicle fractures, and in each of 8.4% cases sternal and vertebrae fractures. SureshKumar et al also argued the same.^[8]

In current study most common abdominal solid organs injured were liver 32.6%, spleen 18.3% and kidney 12.24%. But in Suresh Kumar et al^[8] and Bakkannavar et al^[15] studies argued that most common solid abdominal organ involved was Kidney 48% and 23% respectively followed by liver 39.7%. Study by Ravindra et al^[16] and Maurice et al^[17] contradicted the above both statements they found most common organ injured was spleen (52.9% and 50% respectively). In this study liver and spleen injuries were mostly lacerations than contusions whereas in the kidney contusion was common. Suresh Kumar et al also supported our findings.^[8] The abdomen is vulnerable to injury since there is minimal bony protection for underlying organs. Lungs were the most commonly involved

organ (92.3%) in the thoracic region followed by the heart 7.6%. SureshKumar et al^[8] and Bakkannavar et al^[15] studies confirmed our study findings (61.3% and 61% lung injuries in thoracic region). The lungs occupy most of the rib cage, and thus are probably more vulnerable to injury when compared to the heart. Lungs sustained more lacerations 79.1% than contusions 20.8%.

In this study it was observed that 20% of the victims died on the spot and 39% survived up to 24 hours and majority of the victims (41%) survived more than 24 hours. Archana et al study also supported our findings.^[13] Where as in Meera et al study the results were quite contradictory, 47% of them died on the spot and 44% died within 24 hours.^[18] Most common cause of deaths in RTA was head injury 47.0% followed by irreversible shock 42.0% and in remaining septicaemia was the cause of death. Khajuria et al study also confirmed our findings.^[10] But this observations has been opposed by Ravindra et al^[16] and Meera et al^[18], in their studies shock was the major culprit (62.7%, and 44% respectively).

Heavy vehicles (trucks, oil tanker, lorries, bus etc) have been found to be most responsible for the accidents (54.0%) followed by light motor vehicles (car, jeep, van, taxies) (24.0%) and (12%) two wheeler. This has been supported by other studies.^[9, 13] Main reasons for involvement of the heavy vehicles are rash driving, poor condition of the roads and vehicle and lack of discipline among the drivers.

Conclusion:

Young and productive males were commonly injured in RTA. More than fifty per cent of the accidents were found to occur during the weekends. Most common cause of death in RTA was head injury followed by persistent irreversible shock. Hospitals with designated trauma centers have improved outcomes when compared to hospitals without them, and if trauma victims are transferred directly to a trauma center it can greatly improve the outcome of the trauma case. This study can help the planners to take safety measures, to risk stratification in the susceptible population and the study of nature of offending agent in RTA can help the authorities in propagating safety measures to educate the people and to create better health care facilities (Trauma centers, quick response teams and Ambulances) on roads.

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