PATTERN OF INTRACRANIAL HAEMORRHAGES IN FATAL ROAD TRAFFIC ACCIDENTS

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ABSTRACT

BACKGROUND

Head injury is defined as a morbid state resulting from gross or subtle structural changes in the scalp, skull and/or contents of skull due to application of mechanical forces.[1] Brain is the organ most frequently damaged by blunt trauma. Road traffic accidents constitute the majority of cases of head injuries in the world. Traumatic intracranial haemorrhages constitute a common and treatable source of morbidity and mortality associated with head injury.

The present study is an autopsy study to analyse the medico-legal aspects of intracranial haemorrhages in fatal road traffic accidents.

MATERIALS AND METHODS

The present case series study was done on 154 cases of fatal intracranial haemorrhages due to road traffic accidents brought to autopsy to the Department of Forensic Medicine, Medical College, Trivandrum, during the period from 01. 04. 2000 to 30. 11. 2000.

RESULTS

The study found that road traffic accidents contributed 67% of fatal intracranial haemorrhages followed by fall from height (15%) and the maximum age incidence of road traffic accidents was in the 4th decade. Males constituted 87.7% of victims due to road traffic accidents. Pedestrians topped the list of road traffic accident victims (33.8%) followed by motor cyclists (25.3%) and occupants of vehicles (22.7%). Among the vehicles involved in road traffic accidents, two wheelers were the most commonly involved (40.2%) followed by cars (16.2%) and auto rickshaws (15.6%). The maximum mortality (67.8%) was in the first 24 hours of the occurrence of the accident and 31% died within the first hour itself and skull fracture was present in (74%) of cases. The commonest intracranial haemorrhage was subarachnoid haemorrhage (90.9%) followed by subdural (82.5%), intracerebral (22%) and brain stem (21.4%) haemorrhages. Commonest site of intracerebral haemorrhage was in the temporal lobe (76%) and frontal lobe (44%).

CONCLUSION

In the modern world, trauma is the leading cause of death in people below 40 years of age and the majority of this occur due to traumatic brain injury. Road traffic accidents are the major cause of traumatic intracranial haemorrhages. The most common type of intracranial haemorrhage is subarachnoid followed by subdural, intracerebral and brain stem haemorrhages.

KEYWORDS

Intracranial Haemorrhages, Road Traffic Accidents, Autopsy.

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BACKGROUND

Head injury is defined as a morbid state resulting from gross or subtle structural changes in the scalp, skull and/or contents of skull due to application of mechanical forces.[1] Brain is the organ most frequently damaged by blunt trauma. Road traffic accidents constitute the majority of cases of head injuries in the world. Other common causes of head injuries are falls, blunt impacts, assaults and industrial or other occupational accidents. Mortality from head injuries can be considerably reduced if proper preventive measures are taken to avoid road traffic accidents and protective gears provided to workers engaged in construction and other high-risk occupations. But in our country, death from road traffic accidents and other accidents are still considerably high due to lack of infrastructure like shortage of adequate trauma centres in the highways where accidents are frequently taking place. In the real estate sector, construction workers involved in the high-risk category seldom provided adequate protective gears. Traumatic intracranial haemorrhages constitute a common and treatable source of morbidity and mortality associated with head injury. Bleeding into the parenchyma of brain can occur even without any visible external injury or fracture of skull.

Brain and spinal cord are enveloped safely within the skull cavity and vertebral canal by three membranes named from without inwards as the dura mater, arachnoid and pia mater. The extradural space lies between the dura and periosteum. The subdural space is a potential space between the dura and arachnoid. The arachnoid is separated from pia mater by the subarachnoid space. The subarachnoid space contains the large blood vessels of the brain. In a study conducted by Lewin, 60 - 70 percent of death occurred within the first 24 hours in fatal injuries sustained by blunt trauma.[2] Injuries to the brain may be caused by either distortion of the skull or by movements of the brain in relation to the skull.[3] Nearly, 77% of adults and 62% of children who develop a haematoma have a skull fracture.[4] Severe brain damage can

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occur in the absence of external signs of head injury, conversely severe lacerations and even skull fractures do not necessarily indicate damage to the underlying brain.[5] Extradural haemorrhage is uncommon and represent about 3% of any large series of acute cerebral trauma.[6]

Aims and Objectives

To find out the pattern of various types of intracranial haemorrhages in Road Traffic accidents.

MATERIALS AND METHODS

Study Design

Case series study.

Setting

Department of Forensic Medicine, Govt. Medical College, Trivandrum.

Sample Size

154 cases of fatal intracranial haemorrhages due to road traffic accidents.

Source Population

All cases of fatal intracranial haemorrhages due to road traffic accidents brought for autopsy to the Department of Forensic Medicine, Govt. Medical College, Trivandrum, during the period from 01. 04. 2000 to 30. 11. 2000.

Inclusion Criteria

All autopsies in which death was due to intracranial haemorrhages resulting from road traffic accidents and with known identity were included.

Exclusion Criteria

All unidentified and all decomposed bodies.

Data Collection

Baseline data, history of any disease and a brief history of occurrence were collected from the relatives of the victims as well as from the investigating officer. During the autopsy examination, relevant details were entered in the proforma.

Procedure of Dissection

Post-mortem examination was conducted by the modified Rokitansky method. Clinical case sheets were perused after autopsy with special references to the period of survival, CT scan findings and operative procedures done.

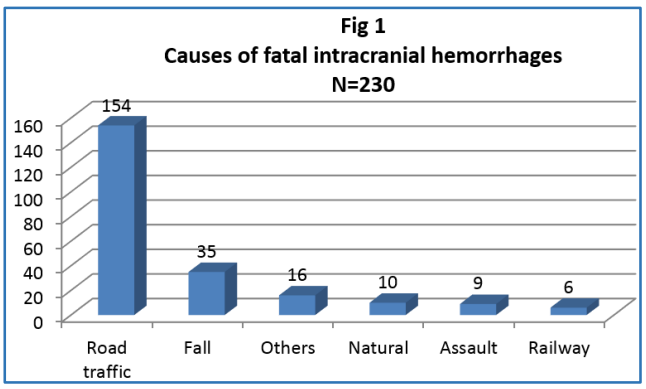
Analysis

Data collected was entered in MS Excel and analysed using SPSS version 15.

RESULTS

Causes of Fatal Intracranial Haemorrhages

There were 230 cases of fatal intracranial haemorrhages during the study period from 01. 04. 2000 to 30. 11. 2000, of which road traffic accidents constituted 154 cases (67%). Other causes of fatal intracranial haemorrhages were fall from height 35 cases (15.2%), other accidents 16 (7%), natural disease 10 (4.3%), assault 9 (3.9%) and railway accidents 6 (2.6%).



Categories of Road Traffic Accidents

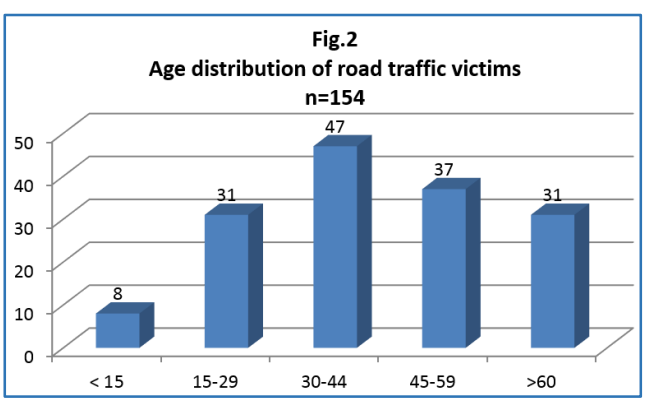
Among the 154 cases of road traffic accident victims with fatal intracranial haemorrhages, there were 52 (33.8%) pedestrians, 39 (25.3%) motor cyclists, 35 (22.7%) passengers, 16 (10.3%) pillion riders, 6 (3.9%) drivers and 6 (3.9%) pedal cyclists.

Victims	Number	Percentage
Pedestrians	52	33.8
Motor cyclists	39	25.3
Occupants	35	22.7
Pillion riders	16	10.3
Drivers	6	3.9
Cyclists	6	3.9
Total	**154**	**100**

Table 1. Categories of Road Traffic Victims (n= 154)

Age Distribution of Road Traffic Victims

The maximum number of road traffic victims was in the 30 - 44 age group, 47 cases (30.5%); and the minimum was in the age group of below 15 years, 8 cases (5.2%). There were 31 cases (20.1%) in the 15 - 29 age groups; 37 cases (24%) in the 45 - 59 age group; and 31 cases (20.1%) in the age group of 60 years and above.



Age Distribution of Different Categories of Road Traffic Victims

Among the 52 pedestrians, the maximum victims 23 cases were in the age group 60 years and above and the minimum number 3 cases were in the age group of 15 - 29 years. There were 4 cases in the below 15 years' age group; 8 cases in the 30 - 44 age group; and 14 in the 45 - 59 years' age group.

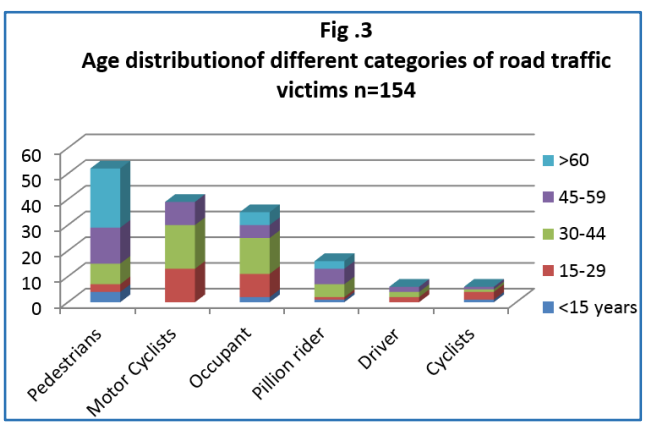
Among the 39 cases of motor cyclists, the maximum number of 17 cases was in the 30 - 44 years' age group and minimum 9 cases were in the 45 - 59 years' age group. The rest 13 cases were in the 15 - 29 years' age group.

Among the 35 occupants of vehicle, the maximum number of 14 cases was in the 30 - 44 age group and minimum of 2 cases was in the below 15 years' age group. Nine victims were in the 15 - 29 age group and 5 each were in the 45 - 59 and above 60 years' age group.

Among the 16 pillion riders, the maximum number of victims (6 cases) belonged to 45 - 59 years' group and minimum of one case each was in less than 15 years and 15 - 29 age groups. There were 5 cases in the 30 - 44 age group and 3 in the above 60 years' group.

Among the 6 drivers 2 each belonged to 15 - 29, 30 - 44 and 45 - 59 years' age groups.

Among the pedal cyclists 3 cases were in the 15 - 29 age group and 1 each were below 15 years, 30 - 44 and 45 - 59 years' age groups.



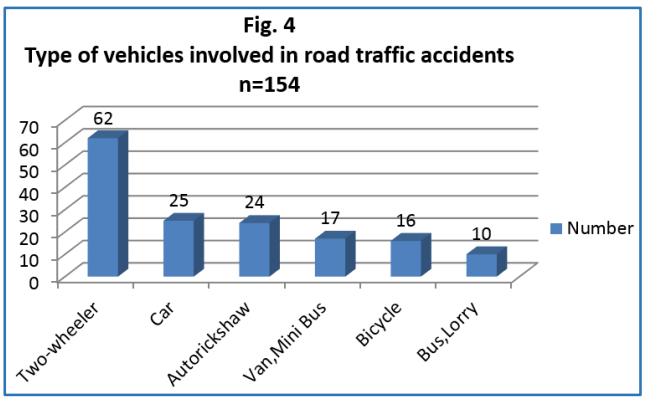
Sex Distribution of different Categories of Road Traffic Accident Victims

Among the 154 cases of road traffic victims, males constituted 135 cases and there were only 19 female victims. Out of the 52 pedestrians, 41 were males and 11 females. Among the 39 motor cyclists, 38 were males. There were 31 males and 4 females among the 35 cases of occupants of vehicle. All the 16 pillion riders, 6 drivers and 6 cyclists were males.

Victims	Males	Females	Total
Pedestrians	41	11	52
Motor cyclists	38	1	39
Occupants	31	4	35
Pillion riders	16	0	16
Drivers	6	0	6
Cyclists	6	0	6
Total	**138**	**16**	**154**

Table 2. Sex Distribution of different Categories of Road Traffic Accident Victims (n= 154)

Type of vehicles involved in road traffic accidents (n= 154): The most frequently involved vehicle was two wheelers numbering 62 (40.2%); Cars 25 (16.2%); auto rickshaws 24 (15.6%); van, mini bus 17 (11%); Bicycle 16 (10.4%); and Bus and Lorry 10 (6.5%).



Head Injuries in Road Traffic Accidents (External)

Scalp injuries were present in 147 out of the 154 cases of road traffic accidents. Face alone was injured in 6 cases. One case presented with no external injury.

Injuries	Location	Percentage
Scalp	147	95.5
Face alone	6	3.9
Total	**154**	**100**

Table 3. Head Injuries in Road Traffic Accidents (External)

Head Injuries in Road Traffic Accidents (Internal)

Out of the 154 victims of road traffic accidents, 114 cases (74%) presented with fracture of skull. Extradural haematoma was detected in 13 cases. Subdural haemorrhage was noted in 127 cases (82.5%), while subarachnoid haemorrhage was noted in 140 cases (90.9%). Intracerebral bleeding was noted in 35 cases (22%); Brain stem haemorrhage in 33 cases (21.4%) and intraventricular bleeding was noted in 7 cases (5%).

Majority of extradural haematomas were located in the temporoparietal region (76%).

Commonest site of intracerebral haemorrhage was in the temporal lobe (76%) and frontal lobe (44%).

The most common presentation of brain stem haemorrhage was diffuse petechiae (43%) followed by pontine haemorrhage.

The most commonly fractured bone in the vault of skull was temporal bone (44.6%), while in the base of skull middle cranial fossa was most involved (47.3%). Pituitary fossa was fractured in 16.2%.

Injuries	Victims	Percentage
Fracture Skull	114	74.0
Extradural Haemorrhage	13	8.4
Subdural Haemorrhage	127	82.5
Subarachnoid Haemorrhage	140	90.9
Intracerebral Haemorrhage	35	22
Brain Stem Haemorrhage	33	21.4
Intraventricular Haemorrhage	7	5

Table 4. Head Injuries in Road Traffic Accidents (Internal)

DISCUSSION

Of all types of injuries, those to the head are most likely to result in death or permanent disability. In traumatic head injury an estimate of incidence, severity and cost reflect enormous losses to the individuals, their families and society. It should be regarded as a public health problem and there

should be an ongoing surveillance to follow trends in the incidence, risk factors, causes and outcome of these injuries. There should be effective scientific strategies to prevent the occurrence as well as to improve the outcome of these injuries and to minimise the disability among those who survive the accident.

Regarding the age incidence of road traffic accident victims, the maximum incidence (31%) was in the 30 - 45 age groups, which is not in agreement with the study conducted by Sevitt (1968).[7] In Sevitt's study, the maximum age incidence was in the above 60 years' age group. This may be attributed to the higher outdoor activities of people above 60 years in the western countries. The chances of accidents will be higher in the elderly due to impairment of vision, hearing and reflexes. In a study conducted by Vijayakumar, the maximum cases of road traffic accidents (31%) were in the age group of 20 - 30 years.[8] Among the different categories of road users in the present study, pedestrians topped the list. This was in agreement with observations made by others. Motor cyclists (25%) formed the second highest group in the present study as well as in the Sevitt study (16.4%). But in the Vijayakumar's study occupants were in the second place and motor cyclists in the third place. Occupants formed 23% in the present study, while it was 13% in the Sevitt study.

Among the pedestrians the maximum number of victims (44.2%) was in the above 60 years' age group, which was in agreement with both Sevitt's and Vijayakumar's studies (61% and 33%, respectively). This can be attributed to the decline in the visual and auditory capacities as well as reflexes in the elderly. Among the fatal cases of motor-cyclists, the maximum victims (66.7%) were in the age group of 30 - 60 years, which was in agreement with Vijayakumar's study in which 62% belonged to 30 - 60 years' age group. But in the Sevitt's study, the maximum age incidence (76%) was in the 15 - 30 years' age group, while it was only 20% in the 30 - 60 years' age group. This can be explained by the fact that in western countries driving under the influence of alcohol and drugs among adolescents and young adults is more widespread compared to our country.

Males constituted 88% and females 12% in the present study. In the Sevitt's study, 69% were males and 31% were females. The higher incidence of females in the Sevitt's study can be attributed to the higher social exposure of females in western countries. Of the 52 pedestrians in the present study 79% were males and 21% were females, while it was 57% and 43% respectively in the Sevitt's study.

The skull was fractured in 114 cases (74%) in the present study, which was in agreement with other studies.[7,8,9,10] The most frequently fractured skull bone was temporal bone (45%) in the present study as well as in other studies. The least fractured bone was occipital bone (18%). Signs of raised intracranial tension was observed in 84% of cases in the present study.

Extradural haematoma had the least incidence, 13 cases (8.4%). It is in agreement with other studies. According to Rowbothom, it is rather uncommon and occurred in only 3% of cases of any large series of cerebral trauma.[11] As per the observations made by Jamieson et al, the incidence of extradural haematoma varied from 5% - 15%.[12] There were 2 cases in the present study in which extradural haematoma had occurred without skull fracture. It was in agreement with the observations made by Galbraith.[13] Bilateral extradural haematomas were found in 2 cases in the present study. Bilateral extradural haematomas are very rare according to observations made by McKissok et al.[14] In the present study there were 114 instances of skull fracture, but only 19 of them had extradural haemorrhages. This is in agreement with the opinion of Lindenberg who states that even though skull fracture is a prerequisite, only less than 20% of skull fractures are associated with an extradural haematoma.[15] The majority of extradural haematomas were located in the temporoparietal region in the present study, which is in agreement with the observations made by Jamieson and Yelland.[12]

The incidence of subdural haemorrhage is 82.5% in the present study, which is higher than the opinion of Youmans who gives an incidence of 40% - 70% of subdural haemorrhages in traumatic head injury.[16] The incidence of subarachnoid haemorrhage was 90.9% in the present study, which is in agreement with others. The incidence of traumatic intracerebral haemorrhage in the present study was 22%, which is in total agreement with the opinion of Zimmerman et al.[17] Extradural haematomas are always traumatic and associated with fracture of skull.[18] The commonest site of traumatic intracerebral haemorrhage in the present study was the temporal lobe and frontal lobe. This is in total agreement with observations made by Browder.[19] The most common type of Brain stem haemorrhage was diffuse petechial haemorrhages, which is in agreement with Polson and Gee.[20] CT scan was taken in 76 cases out of 154 cases. Out of this, 58 cases correlated with the autopsy findings.

CONCLUSION

In the modern world, trauma is the leading cause of death in people below 40 years of age and the majority of this occur due to traumatic brain injury. This study was undertaken to analyse the medico legal aspects of intracranial haemorrhages in fatal road traffic accidents. A total of 230 cases of fatal intracranial haemorrhages due to traumatic and natural deaths autopsied in the Department of Forensic Medicine, Govt. Medical College, Trivandrum, during the period 01. 04. 2000 to 30. 11. 2000 were analysed and a detailed study of deaths due to road traffic accidents was conducted.

The following Conclusions were made-

1. Road traffic accidents contributed 67% of fatal intracranial haemorrhages followed by fall from height (15%).
2. The maximum age distribution in road traffic accidents was in the 4th decade.
3. Males constituted 87.7% of victims due to road traffic accidents.
4. Pedestrians topped the list of road traffic accident victims (33.8%) followed by motor cyclists (25.3%) and occupants of vehicles (22.7%).
5. The maximum age distribution in pedestrians was in the above 60 years' age group, while in motor cyclists and occupants it was in the 30 - 44 years' age group.
6. Among the vehicles involved in road traffic accidents, two wheelers were the most commonly involved

(40.2%) followed by cars (16.2%) and auto rickshaws (15.6%).

7. The maximum mortality (67.8%) was in the first 24 hours of the occurrence of the accident and 31% died within the first hour itself.
8. Skull fracture was present in (74%) of cases.
9. The commonest intracranial haemorrhage was subarachnoid haemorrhage (90.9%) followed by subdural (82.5%), intracerebral (22%) and brain stem (21.4%) haemorrhages.
10. Majority of extradural haematomas were located in the temporoparietal region (76%).
11. Commonest site of intracerebral haemorrhage was in the temporal lobe (76%) and frontal lobe (44%).
12. The most common presentation of brain stem haemorrhage was diffuse petechiae (43%) followed by pontine haemorrhage.
13. The most commonly fractured bone in the vault of skull was temporal bone (44.6%), while in the base of skull middle cranial fossa was most involved (47.3%). Pituitary fossa was fractured in 16.2%.

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