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# Various causes of mortality in patients of head injury: A Nightmare

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## Abstract

**Introduction:** Head injury is an important public health problem today. It is a nightmare, not only for the public but also for the neurosurgeons, because of high morbidity and mortality loss of young people at their productive years. It is also a great financial loss for a family as well as for the country. Unfortunately, incidence of head injury is rapidly increasing in the world, especially in developing countries including India. In India, problem is more acute over last 2 decades, especially due to increased vehicular traffic, poor maintenance of roads and ignorance about traffic rules. In this study we are comparing different causes of mortality in head injury patients.

**Materials and Method:** The present study design was a prospective cohort consisting of moderately and severely brain injured patients consecutively admitted from August 2014 to February 2017 in surgical emergency wards of M.L.B. Medical College, Jhansi, (U.P). 273 patients with severe and moderate head injury with GCS 3-15 were selected for this study in a random manner.

**Results:** In this study, 187 patients were male and 86 female, the male: female ratio being 2.17:1. The maximum no. of patients were due to road traffic accidents i.e. 175 (64.1%) followed by those falling from height i.e. 67 (24.54%). Overall mortality was 68.50% in male patients whereas it was 31.50% in females. Maximum number of head injury patients were young adults in the age group of 20-40 years. Patients with low GCS 3-4 have got the highest mortality (51.65%) thus GCS is a good predictor of the outcome of the patients. The morality increases if pupillary reactions are abnormal. Lesser the midline shift better the survival. Multiplicity and presence of bilateral lesion took the prognosis to a graver side.

**Conclusion:** This study highlights importance of different modes of injury, GCS & CT-Scan findings, age of patients & dominance of male gender in head injuries deaths.

**Keywords:** Head injury, GCS, CT-Scan, Mortality

## Introduction

Head injury is an important public health problem today. Head injury can range from relatively minor damage to scalp & face as laceration, abrasion and bruising to more serious consequences involving damage to brain. It is a nightmare, not only for the public but also for the neurosurgeons, because of high morbidity and mortality loss of young people at their productive years. It is also a great financial loss for a family as well as for the country. Unfortunately, incidence of head injury is rapidly increasing in the world, especially in developing countries including India. In India, problem is more acute over last 2 decades, especially due to increased vehicular traffic, poor maintenance of roads and ignorance about traffic rules. The incidence of head injury per 1 lac population per year range from 56-430.[1,2] The incidence varies in urban and rural population. Among the road traffic accidents 70% have head injuries. Among road accidents 70% of deaths are due to head injures.[3] Majority of deaths occurs during first 72 hours.[4] In India, the studies are from traffic police or from the hospital records.[3,4] Every minute there is an accident and every eight minute there is a death.[5] In India, the incidence of head injury is steadily increasing with urbanization and increasing number of vehicular population.[6] Although outcome of head injuries depends on many factors such as age, sex, pre-existing illness & mode of injury etc. The most significant factors among them responsible for outcome are clinical status of the patients and its co-relation with the cranial CT finding. The following study to assess the incidence of mortality in patients of head injury in terms of age and sex of the patients, the Glasgow Coma Scale score, clinical progression & radiological finding including CT- scan.

## Materials and Method

The present study design was a prospective cohort consisting of moderately and severely brain injured patients consecutively admitted from August 2014 to February 2017 in surgical emergency wards of M.L.B. Medical College, Jhansi, (U.P). 273 patients with severe and moderate head injury with GCS 3-15 were selected for this study in a random manner.

By this study we comprises the various causes of mortality in these patients.

## Results

The maximum no. of patients were due to road traffic accidents i.e. 175 (64.1%) followed by those falling from height i.e. 67 (24.54%).

**Table 1: Distribution of mechanism of head injury**

| S. No. | Mechanism of head injury | No. of patients | Incidence (in %) |
|---|---|---|---|
| 1. | Road traffic accidents | 175 | 64.10 |
| 2. | Fall from height | 67 | 24.54 |
| 3. | Non-fire arm assult | 23 | 8.42 |
| 4. | Firearm assult | 7 | 2.56 |
| 5. | Sports injury | 1 | 0.4 |

In this study, 187 patients were male and 86 female, the male: female ratio being 2.17:1. Fig. show that majority of victims in road traffic accidents are male 134(76.75%). Males and females are nearly equal in fall from height group because in this group majority of patients are children and their activities are not influenced by sex.

**Table 2: Relation between cause of injury and sex**

| S. No. | Mechanism of head injury | No. of patients | No. of cases in males(%) | No. of cases in females(%) |
|---|---|---|---|---|
| 1. | Road traffic accidents | 175 | 134(76.57) | 41(23.43) |
| 2. | Fall from height | 67 | 34(50.75) | 33(49.25) |
| 3. | Non-fire arm assult | 23 | 13(56.52) | 10(43.48) |
| 4. | Firearm assult | 7 | 5(71.43) | 2(28.57) |
| 5. | Sports injury | 1 | 1(100) | 0(0) |

Overall mortality was 68.50% in male patients whereas it was 31.50% in females.

**Table 3: Correlation between mortality & sex of the patient**

| S. No. | Age Group (in years) | Sex | No. of patients | Incidence |
|---|---|---|---|---|
| 1. | 0-20 | M | 41 | 65 |
| | | F | 22 | 35 |
| 2. | 20-40 | M | 98 | 79.67 |
| | | F | 25 | 20.33 |
| 3. | 40-60 | M | 38 | 58.46 |
| | | F | 27 | 41.54 |
| 4. | ≥60 | M | 10 | 45.45 |
| | | F | 12 | 54.55 |

It was found that maximum number of head injury patients were young adults in the age group of 20-40 years (45.05%).

**Table 4: Incidence of head injury causing death in different age group**

| S. No. | Age Group (in years) | No. of patients | Incidence (In %) |
|---|---|---|---|
| 1. | 0-20 | 63 | 23.08 |
| 2. | 20-40 | 123 | 45.05 |
| 3. | 40-60 | 65 | 23.80 |
| 4. | ≥60 | 22 | 8.05 |

The study shows that the patients with low GCS 3-4 have got the highest mortality (51.65%) while the patient with GCS 7-8 have only 13.55% mortality and thus GCS is a good predictor of the outcome of the patients.

**Table 5: Mortality associated with GCS in head injury**

| GCS | Outcome | |
|---|---|---|
| | No. of patients | Incidence (%) |
| 3-4 | 141 | 51.65 |
| 5-6 | 55 | 20.15 |
| 7-8 | 37 | 13.55 |
| 9-10 | 20 | 7.34 |
| 11-12 | 11 | 4.03 |
| >13 | 9 | 3.30 |
| Total | 273 | 100 |

The morality increases to a significant level (78.39%) if pupillary reactions are abnormal.

**Table 6: Mortality associated with pupillary reaction**

| Pupillary reaction | Outcome | |
|---|---|---|
| | Total no. of patients | Incidence (%) |
| Normal | 61 | 22.34% |
| Bilaterally impaired | 212 | 77.66% |

Majority of expired patients (27.6%) of head injury have associated long bone or pelvic fracture.

**Table 7: Systemic injury in patients expired due to head injury**

| S. No. | Type of injury | Incidence |
|---|---|---|
| 1. | Long bone or pelvic fracture | 79 (27.6%) |
| 2. | Maxillary or mandibular fracture | 16 (5.65%) |
| 3. | Major chest injury | 12 (4.24%) |
| 4. | Abdominal visceral injury | 10 (3.53%) |
| 5. | Spinal injury | 6 (2.1%) |

CT-scan was done 245 patients out of total 273 patients and in 28 patients CT scan were not done.

Most of the patients were that of contusion (36.33%) and acute subdural hematoma ranked second

to it (21.22%). Among total scans patients with normal CT scan is found to have least mortality (4.1%).

**Table 8: Mortality in different CT finding category**

| S. No. | CT finding category | Mortality | |
|---|---|---|---|
| | | No. of patients | Incidence (in %age) |
| 1. | Extradural hematoma | 30 | 12.25 |
| 2. | Acute subdural hematoma | 52 | 21.22 |
| 3. | Intracerebral hematoma | 30 | 12.25 |
| 4. | Cerebral Contusion | 89 | 36.33 |
| 5. | Cerebral oedema | 40 | 16.33 |
| 6. | Intraventricular haemorrhage | 15 | 6.12 |
| 7. | Subarachnoid haemorrhage | 40 | 16.33 |
| 8. | Normal scan | 10 | 4.17 |

It was found that lesser the midline shift better the survival.

**Table 9: Correlation of midline shift with mortality**

| Midline shift | No. of case | Mortality (%) |
|---|---|---|
| < 3 mm | 14 | 34.13 |
| > 3 mm | 27 | 65.86 |

In this study 87 patients having compressed basal cistern out of 245 patients in which CT scan had done. So the incidence was 35.51%. It was observed that with increase in compression mortality also increases.

Data in the present study suggested that the mortality is highest (60.81%) in the patients who were unconscious throughout their course.

**Table 10: Mode of presentation and mortality**

| Mode of presentation | Mortality (%) |
|---|---|
| Unconscious throughout | 166(60.81) |
| Initially unconscious and recovered | 35(12.82) |
| Initially conscious, followed by loss of consciousness | 20 (7.33) |
| Initially unconscious followed by recovery followed by second loss of consciousness (lucid interval) | 52(19.05) |

In majority of patients injuries were Bilateral (77.14%) and multiple (64.29%). Unilateral lesions were also seen in some patients. Multiplicity and presence of bilateral lesion took the prognosis to a graver side.

**Table 11: Mortality associated with numbers of injury**

| Site of Lesion | Total No. of Patients | Mortality (%) |
|---|---|---|
| 1. Unilateral | 56 | 22.86 |
| Single | 20 | 35.61 |
| Multiple | 36 | 64.29 |
| 2. Bilateral | 189 | 77.14 |

In majority of patients expired by head injury having lesion in frontal lobe (49.62%) followed by temporo-parietal (33.97%).

**Table 12: Sites of lesion of affected mortality in head injury patients**

| Site of lesion | No of patients | Incidence (%) |
|---|---|---|
| Frontal | 130 | 49.62 |
| Temporo-parietal | 89 | 33.97 |
| Parieto-occipital | 43 | 16.41 |

In this study 53 patients having history of alcohol intake. The incidence was 29.33%. So alcohol intake was also a major contributing factor of mortality in head injury patients.

## Discussion

Commonest cause of head injury is road traffic accidents In a study conducted by Kraus J. F. in 1990, 60% of injuries were due to road traffic accidents and 20% to 30% of all injuries were due to fall.[7] In present study road traffic accidents account for 64.10% of head injury followed by fall from height (24.54%). This slight increase in road traffic accidents is due to industrialization, uncontrolled traffic, poorly constructed roads with deficient street lights, increased alcohol abuse and lack of civic sense.

In a study done by Kraus J. F. (GENEVA 1990) overall head injury was less common in females, male to female ratio of incidence being 3:2.[7] In our study the male: female ratio was found to be 2.17:1. This disparity in incidence is due to the fact that males are more involved in driving and activities outside the house in our country and hence are more prone for injury than female.

In this series 134 males (76.57%) suffered from severe head injury due to road traffic accidents as compared to 41 females (23.43%). As already discussed this increased proportion in males is due to more activities by them outside the house. Male and females are nearly equal i.e. 34 males (50.75%) in comparison to 33 females (49.25%) in fall from height group. This is due to the fact that in this group majority are children, and there activities are not influenced by sex.

In a study conducted by Reverdin A. (Geneva, 1990) head injury is most frequent in young people between 20-40 years of age.[8] Around 60-70% head

injury occurs in human beings in 30s and 40s of their life. In another study by Kalyanaraman S. in 1971[9] and Mahapatra A. K. in 1995[10] 25-27% of all head injury victims are children under 16 years of age.

In the present study, majority of patients (45.05%) belong to age group of 20-40 years. This is the group which is maximally involved is activities outside the house, driving, quarrel hence most susceptible. Next in the ranking came the children in 0-20 year's age group having the incidence of 23.07%. Most common mechanism of injury in this group is fall from height as children are most prone for it.

Marshal L. F. (1991) in his study points out that the patients having the age more than 61 have worst prognosis (78% dead) in comparison to only 17% mortality is children in the age group 0-20 years.[11] Leurssen et al. (1988) also showed that at same GCS adults had worse outcome than children.[12]

In this study 87 patients in age group more than 41 years expired (31.85% mortality) as compared to 0-20 years age group in which only 63 patients expired (mortality 23.08%).

Higher mortality in older age group is due to the fact that they have associated degenerative changes along with multiple medical problems which lead to increased mortality.

According to Marshall L.F. (1991) GCS provides simple grading of the arousal and functional capacity of the cerebral cortex. He found that as the GCS rises there is precipitous decline in mortality.[11]

In our study there is 51.65% mortality among the patients having GCS 3-4 which is comparable to 78.4% in the study of Marshall L.F. As the GCS rises to 7-8 the mortality declines to 13.55% which too is close to 7.7% in GCS >8 in Marshall L.F. study and so it is obvious that GCS is a good predictor of the outcome of the patients.

Narayan R.K. et al. (1981) in his study emphasized that pupillary response serves as a measure of brain stem function. He found out that 61% of patients with bilaterally impaired pupillary reaction are dead as against only 16% expiry in patients having normal pupillary reaction.[13]

In present study 77.66% patients with bilaterally impaired pupillary reaction were dead as against 22.34% expiry in patients having normal pupillary reaction.

Patients of severe head injury are usually a victim of multi trauma. Associated systemic injury leads the prognosis towards graver side.

Miller J.D. et al. in 1981 in a study of 100 patients reported long bone or pelvic fracture in 32 patients.[14] In our study long bone or pelvic fracture was found in 79 (27.6%) patients. Only 6 patients (2.1%) have associated spinal injury.

In this study 40 scans were that of cerebral oedema (16.33%). The reason for this high incidence is that, it is associated with scans having other lesion too.

Patients with normal CT scan are found to have significantly low mortality (4.17%). Kishore P.R.S. et al. (1981) found 19% poor outcome rate in their patients of normal CT scan.[15] Narayan R.K. et al. (1981) noticed a significantly higher proportion of survival outcome in patients with normal CT scans as compared to those with high density lesion.[13] Lobato R.D. et al. (1986) found a 4.6% mortality rate in their patients of normal CT scans.[16] Thus it can be inferred that even severely head injured patients can be predicted to have good outcome it their initial CT scan is normal.

In this study mortality increases form 35.61% in patients having single lesion to 64.29% in patients having multiple lesion in CT. This is comparable to study conducted by Gupta R. at AIIMS (1993) in which 88.23% survival was found in patient having high single lesion and 50% survival was found in patients having multiple lesion.[17]

In a study conducted by Gupta R. at AIIMS 50% survival was noted with shift <3 mm and not a single patient survived with midline shift >3mm.[17] In our study series 34.13% mortality was noted with midline shift <3 mm as compared to 65.86% mortality in patients with midline shift >3 mm in CT scans. So lesser the midline shift better the survival.

Lipper MH et al (1985) noted that the degree of midline shift is a significant prognostic indicator by itself. Their 64% patients with midline shift $\geq$3.8 mm did poorly.[18]

The status of basal cistern was noted in 87 patients in this study. The incidence of mortality in my study was 35.51%. Eisenberg HM et al (1990) found that the risk of dying is increased two fold if the basal cisterns are compressed or obliterated and that the underlying pathology causing the abnormal cisterns did not appear to influence this association.[19]

In a study conducted by Mc Kissock W. et al (1960)[20] followed by another study by Jamieson KG et al (1963),[21] lucid interval was found in 12.34% of patients with extradural hematoma. In this study, incidence of lucid interval is found to be 19.05% which is in accordance with the above studies.

## Conclusion

- Majority of patients (61.8%) sustain head injury due to road traffic accidents.
- Males are more prone to head injury than female (Male: Female ratio is 2.17:1). When the cause of injury is fall from height, then the males are nearly equal to female (male: female ratio is 1.03:1).
- Head injury is most common (45.05%) in 20-40 years of age group. as the age advances mortality in head injury patients also increases.
- GCS is a good indicator of the outcome of the patient. Patients with low GCS (3-4) have got the highest mortality (51.65%).

- Pupillary reaction also gives an idea about the outcome of the patients. There is 77.66% expiry in patients having bilaterally impaired pupillary reaction.
- Long bone or pelvic bone fracture is common (27.6%) in patients of severe head injury.
- Cerebral contusion is most common CT finding having mortality (36.33%) among the patients of head injury. Next common finding is that of acute subdural hematoma having mortality (21.22%).
- Patients with normal CT scan were found to have significantly low mortality (4.17%) and thus severely head injured patients can be predicted to have good outcome if their initial CT scan is normal.
- Number of lesions in CT scan affect mortality of the patients. Mortality increases from 22.86% in patients having single lesion to 64.29% in patients having multiple lesion in CT scan. Bilateral lesions also shift the prognosis more graver side.(77.14%)
- Mid line shift is associated with poor prognosis. 65.86% patients were expired with mid line shift greater than 3 mm in CT scan.
- Degree of cisternal compression is related to the prognosis of the patient. 35.15% of patients having obliterated basal cisterns are expired.

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