

## Management of Traumatic Brain Injury: A Two-Year Institutional Experience

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### Abstract

**Background:** Traumatic brain injury (TBI) is a silent epidemic not only in developing but developed world, which is a major cause of serious morbidity and mortality, especially among youngsters.

**Objectives:** To study the different aspects and management of traumatic brain injury (TBI) patients in a tertiary care hospital.

**Methods:** This descriptive cross-sectional study was conducted in the department of Neurosurgery, PAF Hospital, Fazaia Medical College, Islamabad from September 2022 to August 2024. Patients with either sex and of all ages were in the inclusion criteria, while patients with recurrent TBI and co-morbidities were excluded. All the details were collected in a pre-designed form. Data analysis was done using SPSS software version 25.

**Results:** Out of total 216 TBI patients, 74% were male, while 26% were female. Majority of the patients were in the first three decades of their life (64%). Most of the patients sustained TBI due to Road Traffic Accident (RTA), i.e., 53%, followed by history of fall 33%. At the time of presentation in all the TBI patients, the TBI was mild in almost 50%, moderate in 30% and severe in 20%. The most common radiological findings were brain edema (13%), brain contusions (12%) and extradural hematoma (10%), followed by others. Seventy-two percent of all TBI patients were managed conservatively, while others need surgery. At the time of discharge and final follow up the Glasgow Outcome Scale was good recovery in about 76% of the patients.

**Conclusion:** Majority of the patients were male. The TBI is mostly due to RTA. First three decades of life is the most common age group affected in TBI patients. Most of the TBI patients presented to hospital with mild to moderate TBI. The proper and timely management of TBI resulted in good GOS.

**Keywords:** Traumatic Brain Injuries, Traffic accident, Brain Edema, Epidural Hematoma, Subarachnoid hemorrhage.

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## INTRODUCTION

Traumatic brain injury (TBI) is a silent epidemic not only in developing but developed world, which is a major cause of serious morbidity and mortality, especially among youngsters.<sup>1</sup> TBI is defined as, “an alteration in brain function or evidence of brain pathology caused by an external force”.<sup>2</sup> Although there are significant advances in the management of TBI, like ICP monitors, brain micro-dialysis measures and much more, but unfortunately the patients of TBI causes a tremendous amount of socio-economic and healthcare burden and that more in LMICs.<sup>2-4</sup> Internationally, the incidence of TBI is persistently towards increasing trend, because of the reasons like; motorization, urbanization, insufficient application of road safety precautions. The literature stated that about 27 million new cases were reported of TBI globally in 2016.<sup>5, 6</sup> In USA more than 1 million patients were reported of TBI with round about 50,000 mortalities each year and the patients of TBI who lived with long-term disabilities were around 5.3 million.<sup>5</sup> TBI is also significantly prevalent in Europe, as 1.5 million admissions and mortalities of about 57,000 are related with it.<sup>7</sup>

Road traffic accident (RTA) is the number one cause of death in TBI patients sustained by adults, while in elderly, fall is the leading cause of TBI and the estimated annual cost of TBI burden, in a study in USA showed, more than 70 billion USD.<sup>3, 4, 8-14</sup> TBI mostly affects population who are in the most productive stage of their life, i.e., the first 3 decades of life, which ultimately results in unbearable loss for the families and causes enormous extensive economic loss and impact.<sup>4, 8</sup> The classification of TBI is multi-modal, but mainly it is classified according to the severity as mild, moderate and severe. This severity is based on the conscious state of the patient according to the internationally validated Glasgow Coma Scale (GCS). The prognosis and outcome as well as the management strategies of TBI patients is usually based on the GCS score. Neuroimaging in the form of most important modality, CT scan brain, plays very crucial role to identify extra and intracranial traumatic pathologies and lesions, hence directing towards timely neurosurgical interventions.<sup>3, 15</sup> The management of

TBI is multi-faceted and comprises of multidisciplinary team approach, which basically starts with ATLS protocol, securing airway, maintaining breathing, hemodynamic stability and then specific management to optimize the raised ICP. Which included either conservative or surgical management depending upon the clinical condition and neuro-radiological findings. All this is mandatory for optimum patient outcome and to reduce morbidity and mortality in TBI patients.<sup>12</sup>

Although there is trend of advancements in the management of TBI patients due to different newer therapeutic and diagnostic tools, the final outcomes of TBI patients are not up to the mark, because of the fact that in some regions, there are lack of proper resources, late presentation of patients, ineffective or no prehospital care and sub-optimum emergency department management. Keeping in view this very important fact in mind, multiple institutional trials regarding management of TBI patients are mandatory, to know the local burden of the disease and to formulate the healthcare policies accordingly. The current study is hence conducted to look and to evaluate the epidemiological data, clinical features, neuroradiological characteristics, treatment and finally the outcome of TBI patients presented to a tertiary care hospital. The results will not only help in knowing the facts and figures related to TBI epidemiology in our region but will also guide the stake holders in formulating a preliminary preventive measure.

## METHODS

This descriptive cross-sectional study was conducted in the department of Neurosurgery, PAF Hospital, Fazaia Medical College, Islamabad from September 2022 to August 2024. Patients with either sex and of all ages were in the inclusion criteria, while patients with recurrent TBI and co-morbidities were excluded. The sampling technique was non-probability consecutive sampling and sample size was not calculated, because it was a census technique. All the details were collected in a pre-

designed form. Data analysis was done using SPSS software version 25.

All the patients were subjected to thorough clinical history and examination with all the relevant investigations, especially CT (computerized tomography) scan of brain with bone window. Patients were initially managed as per standard ATLS support in the Accident and Emergency department of PAF Hospital, Islamabad. Airway and breathing were optimized, followed by hemodynamic stability of the patient and management of TBI accordingly. If the patient/s need surgery then preparations were done accordingly, after taking proper informed consent from the patient if he/she is stable or the legal guardian, in case patient is unconscious. The management of the patients and outcomes were reviewed and documented. Patients were assessed at the time of discharge again according to the well-known Glasgow Outcome Scale. The study did not demand inferential statistics. Ethical approval of the study was sought from the Hospital Ethical Review Board before the start of the study. The application number of ethical committee is 1010/NMC-EC.

## RESULTS

A total number of 216 patients were studied. Out of those 216 patients 160 (74.07%) were male, while female was 56 (25.92%) with male to female ration of 3:1. When we look at the age range, so the majority of our patients were less than 10 years of age, i.e., 58 (26.85%), followed by 51 (23.68%) and 29 (13.42%) were in the age range of 10-20 years and 21-30 years respectively (Figure I). The cause of TBI was RTA in majority of our patients, 115 (53%), followed by history of fall 71 (33%), history of blunt trauma 28 (13%) and only 2 (1%) patients sustained TBI due to physical assault. Most of the patients presented to the hospital with mild to moderate head injury (80%), while only 20% presented with severe TBI (Figure II). The major radiological findings (CT scan) were Brain edema, contusions and epidural hematoma (35%), followed by subgaleal hematoma,

interventricular hematoma, sub-arachnoid hemorrhage and others (Table I). In 17 (7.87%) of our patients the CT scan was unremarkable and was labelled as diffuse axonal injury. We managed all the patients, as per standard protocols. Initially according to the ATLS guidelines, followed by specific measures to take control of the raised intracranial pressure. One hundred and fifty-five patients (71.75%) were managed conservatively, while only 61 patients (28.25%) needed surgical intervention. Radiological images, pre-operative and post-operative of three of the patients are shown in Figures III - V. The Glasgow Outcome Scale of the patients at the time of discharge was in Good Recovery (164 patients,

75.92%) in majority of the patients and there was mortality in 9 (4.16%) patients (Table II). The hospital stay ranged from 1-32 days, with mean of 3 + 2.86 days.

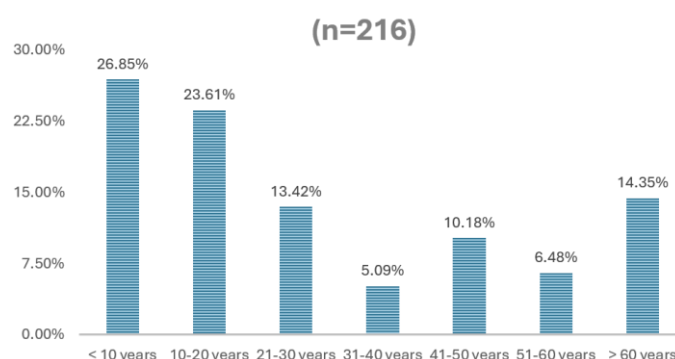


FIGURE I: Age-wise distribution

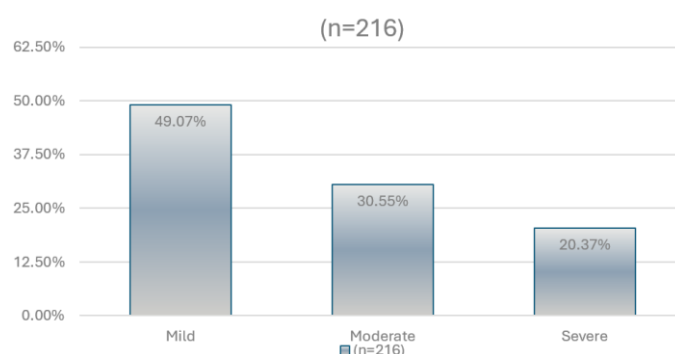


FIGURE II: Severity of TBI

Table I: Radiological findings of TBI patients

| Findings                    | No. of Patients | Percentage |
|-----------------------------|-----------------|------------|
| Brain edema                 | 28              | 12.96      |
| Brain contusions            | 27              | 12.5       |
| Epidural hematoma           | 22              | 10.18      |
| Subgaleal Hematoma          | 18              | 8.33       |
| Interventricular hemorrhage | 17              | 7.87       |
| Subarachnoid hemorrhage     | 16              | 7.4        |
| Acute Subdural hematoma     | 15              | 6.94       |
| Skull bone Linear fracture  | 15              | 6.94       |
| Depressed skull fracture    | 14              | 6.48       |
| Contusion + Brain edema     | 13              | 6.01       |
| Intracerebral hematoma      | 10              | 4.62       |
| Contusion + fracture + SAH  | 2               | 0.92       |
| Acute SDH + Brain edema     | 2               | 0.92       |
| Unremarkable (DAI)          | 17              | 7.87       |
| Total                       | 216             | 100        |

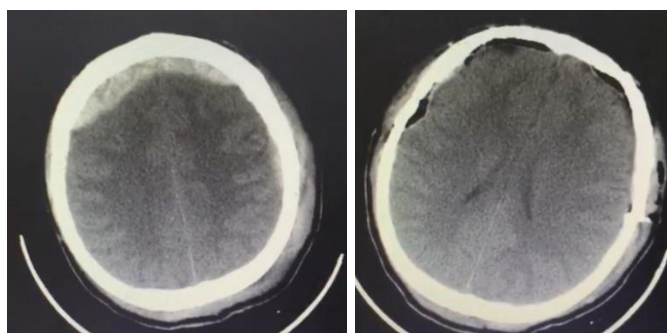


FIGURE III: Pre and post-operative CT scan of Bifrontal Epidural Hematoma

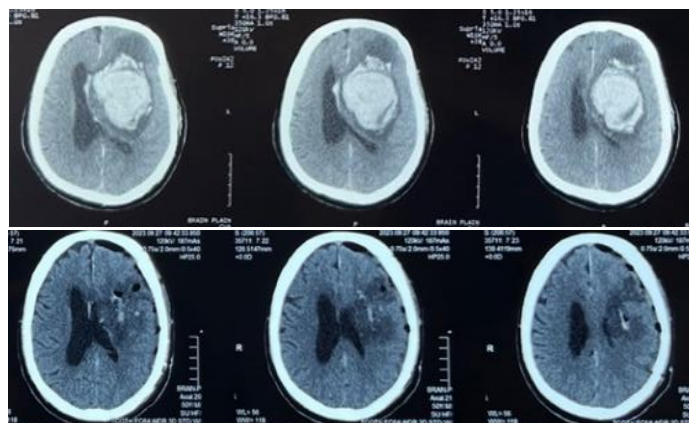


FIGURE IV: Pre and post-operative CT scan of Left Intra-cerebral bleed

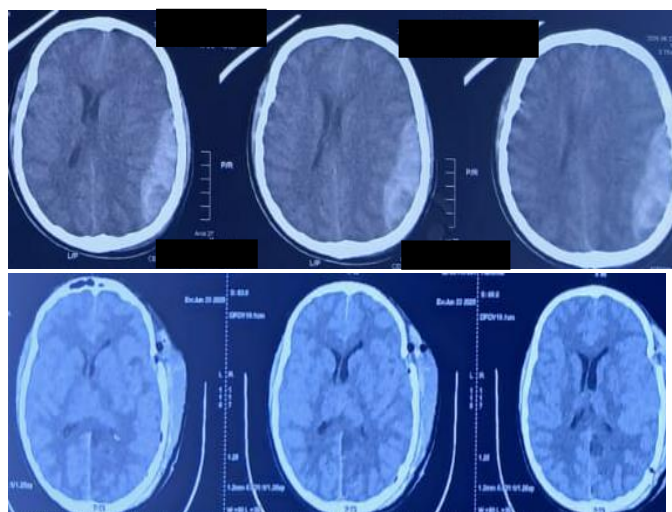


FIGURE V: Pre and post-operative picture of Large Subdural Hematoma

Table II: Glasgow Outcome Scale of TBI patients

| Glasgow Outcome Scale | Number of Patients | Percentage |
|-----------------------|--------------------|------------|
| Good Recovery         | 164                | 75.92      |
| Moderate Disability   | 24                 | 11.11      |
| Severe Disability     | 13                 | 6.01       |
| Vegetative State      | 6                  | 2.77       |
| Dead                  | 9                  | 4.16       |
| Total                 | 216                | 100        |

## DISCUSSION

In the current study emphasis was made on important TBI findings with respect to initial presentation, demographic data, radiological findings, initial and then subsequent treatment and most importantly the outcome in a tertiary care setting. In our study the males were predominate (74%) and this finding is compatible with national and international literature.<sup>1, 16, 17</sup> A study from Karachi and Peshawar showed almost similar male predominancy (73.1% and 74.4% respectively), which is because of the obvious reasons as; occupational risks, more outdoor activities, and most importantly the RTAs.<sup>16, 1</sup>

In this study, the most affected TBI patients were in the first three decades of life (64%), with majority under 10 years of life (27%). This data is consistent with national and international literature.<sup>2, 4, 18</sup> A study on TBI conducted at a tertiary care hospital of Punjab, showed higher involvement of younger individuals in TBI.<sup>19</sup> This tendency signifies the socioeconomic burden on the society of TBI patients, as this phase of life is active and usually outnumbers the other road users and causes significant economic impact on their families, as sometimes they are the only bread earners.

In the current study RTA (53%) is the leading cause of TBI, followed by falls (33%). This finding is also somewhat compatible with international and regional studies<sup>1, 8, 16, 18</sup> in which RTA is the cause of TBI in the range of 39-53% of the cases. That proportion of TBI due to RTA could easily be prevented, as discussed in our previous study.<sup>18</sup> Secondly, this important data of TBI due to RTA, echoes non-compliance of road safety measures, seatbelt and helmet use compliance, and alarming increasing number of vehicles in the cities in the developing world. Although, recent TBI studies<sup>8</sup> also showed increasing number of TBIs due to falls, which is somewhat documented in the current study.

In most of the patients presented with mild to moderate TBI (80%) and this data aligns with the literature. In an emergency department TBI study in Pakistan, showed 72% of the patients presented with mild TBI with only small number of

patients presented with severe TBI.<sup>16, 20, 21</sup> This finding reflects important measures to treat TBI by opting proper triage, following ATLS protocols and prevention of secondary TBI, even in mild TBI cases. Brain edema, contusions and epidural hematoma were the most common radiological findings in TBI patients in our study. These radiological findings are consistent with the other studies reported globally.<sup>15, 18, 22</sup> The clinical diagnosis of diffuse axonal injury based on normal CT scan, highlighted one of the limitations of the CT scan, a challenge which is also documented in a regional study in Khyber Pakhtunkhwa province, where advanced neuroimaging such as MRI brain is not always accessible.<sup>22</sup>

In our study most of the patients (72%) were managed conservatively, while only 28% needs surgical intervention. This data reflects the proper management strategies for TBI patients, which starts with ATLS protocol and then ICP management with conservative management, and surgical usually reserved for intracranial hematomas, significant midline shifts, depressed skull fractures and raised ICP, which is refractory to medical management. Timely and optimum intervention in TBI patients has been significantly shown improved outcomes in TBI patients.<sup>1, 5, 10, 18</sup> This finding is compatible with other regional studies, where most of the TBI patients were managed conservatively, because of nature of the disease, which is mild to moderate in maximum patients.<sup>18, 23</sup>

We analyze the prognosis of our patients through the internationally known tool, Glasgow outcome scale (GOS), which showed good recovery in majority of our patients (76%). This outcome is worth mentioning and comparable with the international standards.<sup>24</sup> Furthermore, two multi-center studies on TBI documented that TBI patients had good recovery if there are proper emergency departments management and easy access of patients to the tertiary care hospitals, with neurosurgical expertise.<sup>1</sup> The comparatively low mortality rate of about 4.16%, in our study, may be due to early intervention, strict adherence to ATLS protocols, multi-

disciplinary approach and availability of neurosurgery services 24/7. Despite the favorable outcomes in most of the studies, there are still

challenges in the management of TBI patients in developing countries, like limited or suboptimum pre-hospital care, variability in healthcare facilities in public and private hospitals and availability of neurosurgery expertise, which is somewhat highlighted in a regional study.<sup>24</sup>

The mean hospital stay was short in our study, which reflects timely and early management of TBI patients. But long-term neurological outcome especially cognitive outcome was not assessed in the study, which is one of the limitations. The other limitations are single-center study and descriptive

nature of study. All these limits the generalizability of the data. To overcome this, future multi-center

trials with long term follow up data is pivotal to better understand the needs for TBI policies as well as rehabilitation needs in these cohort of patients.

## CONCLUSION

Majority of the patients were male. The TBI is mostly due to Road traffic accidents. The patients affected by TBI are majority in the first three decades of life, because this age group outnumbers the other age groups with respect to the use of automobiles, especially the people in second and third decade of life. Most of the TBI patients presented to hospital with mild to moderate TBI. The proper and timely management of TBI resulted in good GOS.

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