EAS Journal of Anaesthesiology and Critical Care
Abbreviated Key Title: EAS J Anesthesiol Crit Care
ISSN: 2663-094X (Print) & ISSN: 2663-676X (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-7 | Issue-5 | Sep-Oct-2025 | DOI: https://doi.org/10.36349/easjacc.2025.v07i05.010

Original Research Article

Management of Severe Head Injuries in the Intensive Care Unit at Dalal Jamm National Hospital

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Article History
Received: 05.08.2025
Accepted: 04.10.2025
Published: 08.10.2025

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Objective***: To evaluate the epidemiological, clinical, paraclinical, therapeutic, and evolutionary aspects of severe traumatic brain injuries (TBI) admitted to the intensive care unit at Dalal Jamm National Hospital. ***Methodology***: This is a retrospective, descriptive, and analytical study conducted over a period of 30 months (January 2022–June 2024) on patients with severe TBI, Glasgow ≤ 8, admitted to the intensive care unit at Dalal Jamm Hospital. ***Results***: The incidence of severe TBI was 5.1% with a mean age of 21.98 years (range 18 months to 67 years). Males predominated with a sex ratio of 5. The 15-30 age group was the most affected. Road traffic accidents were the most common cause (63% of cases), followed by falls due to work-related or recreational accidents (26%). Medical transport was used for 17% of patients. The average time to admission to intensive care was 2.39 hours. A Glasgow Coma Scale score between 3 and 4 was noted in 10% of patients, 30% had a score between 5 and 6, and 60% between 7 and 8. Brain CT scans were performed in 90% of cases. Severe TBI was part of multiple trauma in 60% of cases. Edematous-hemorrhagic contusion was the most frequently found lesion (33%). The secondary systemic cerebral injuries (SSCI) noted were arterial hypotension (46.67%), acute anemia (40%), and arterial hypertension (23.33%). All patients were intubated, ventilated, and sedated. Surgical indications were established in 36.6% of patients, and surgery was performed in 17% of patients. The outcome was favorable in 36.67% of cases and unfavorable in 63.34% of cases. Complications included VAP (33%), pressure ulcers (30%), and urinary tract infections (23%). Overall mortality was 63.34%, with septic shock (52.6%) as the main cause. The average length of stay was 9.77 ± 12.02 days, ranging from 1 hour to 58 days. The factors for poor prognosis were a Glasgow score between 3 and 6 and a pupillary abnormality on admission. ***Conclusion***: Severe TBI mainly affects young adults. It is associated with high morbidity and mortality in intensive care. Treatment must be early and take into account systemic brain damage in order to improve the prognosis.

Keywords: Severe TBI, Morbidity and Mortality, Intensive Care Dalal Jamm.

INTRODUCTION

A major health and socioeconomic problem, head trauma is serious in both the short and long term. It is the leading cause of death among young people under the age of 25 [1-3].

Its management has evolved considerably in recent years, taking particular account of a major pathophysiological factor: the occurrence of secondary injuries, the main risk of which is cerebral ischemia.

The causes of secondary systemic aggression (SSA) can most often be prevented or treated. This acute phase management involves strategic choices throughout the chain, from collection and prehospital transport to the hospital phase, which combines imaging, anesthesia-resuscitation, monitoring, and neurosurgery [4].

The objective of our study was to determine the epidemiological, clinical, paraclinical, therapeutic, and evolutionary aspects of severe head trauma in the multi-purpose intensive care unit at the Dalal Jamm National Hospital Center (CHNDJ).

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PATIENTS AND METHODS

We conducted an observational, cross-sectional, retrospective, descriptive, and analytical study from January 2022 to June 2024 in the general intensive care unit of the Dalal Jamm Hospital in Guédiawaye.

We included in our study all patients admitted for severe TBI, either isolated or as part of a severe trauma, regardless of age. All patients admitted for mild or moderate TBI were not included in our study. We excluded from our study all patients whose hospital records were incomplete or could not be found.

We studied epidemiological, clinical, paraclinical, therapeutic, and evolutionary data. The data were entered into Word 2016 and analyzed using SPSS 20.0 software. The graphs were formatted using Microsoft Excel 2016 software.

The statistical test used was the Chi-square test. A P value < 0.05 was considered significant.

RESULTS

Over a period of 30 months, 88 cases of traumatic brain injury were admitted to the intensive care unit at Dalal Jamm Hospital, including 30 cases of severe traumatic brain injury, representing an incidence of 34.09%. The frequency of severe TBI in the intensive care unit was 5.1%. The average age was 21.98 years ± 16.7 ( ) with extremes of 18 months and 67 years ( ) and a median of 18.5 years. The 15-30 age group was the most represented, accounting for 47% of the total. There was a predominance of males, with a sex ratio of 5. The etiological circumstances found were, in order of frequency: road traffic accidents (63%), work-related and recreational accidents involving falls from height (26%), and domestic accidents (10%). Transport was provided by the national emergency medical service (SAMU) in 17% of cases. The time to admission ranged from 30 minutes to 96 hours, with an average of 2.39 hours. The majority of patients were admitted between 1 and 2 hours after the accident, i.e., 41.3%. Neurological examination showed that 60% of patients had a Glasgow Coma Scale score between 7 and 8, 30% between 5 and 6, and 10% between 3 and 4. The pupils were normal in 47% of patients, with anisocoria and bilateral mydriasis accounting for 43% and 10% of cases, respectively. Computed tomography (CT) was performed in 90% of patients, and among them, 48.14% had undergone a body scan. Brain injuries were dominated by edematous-hemorrhagic contusions (33%), fracture-embarrures (23%), and subarachnoid hemorrhages (20%). Table I shows the main injuries found on brain scans.

Table I: Main lesions found on brain scans

Brain injuries	Number	Percentage
Edematous-hemorrhagic contusion	10	3
Fracture - impaction	7	23
Subarachnoid hemorrhage	6	20
Subarachnoid hemorrhage	5	17
Ventricular flooding	5	17
Subdural hematoma	4	13
Petechiae	4	13
Extradural hematoma	3	10
Cerebral edema	3	10
Diffuse axonal injury	2	7
Pneumoencephaly	1	3

The most common systemic secondary brain injuries (SSBI) were: arterial hypotension (46.67%); acute anemia (40%); and arterial hypertension (23.33%).

Hospital management was based on early orotracheal intubation with assisted ventilation, with an average delay of 2 hours ± 0.83, ranging from 1 to 4 hours Sedation was mainly achieved with midazolam in 83.4% of patients, while thiopental was used in only 16.6% of patients.

In addition to the hypnotic, a morphine derivative, fentanyl, was also used in all sedated patients. The average duration of sedation was 4.56 days ± 3.96, with extremes ranging from 1 to 17 days. Hemodynamic control was achieved through vascular filling (46.67%) and the use of vasopressor amines (43.4%); osmotherapy based on mannitol (23.3%); correction of observed ACSOS (63.3%); and appropriate treatment of associated injuries.

Neurosurgery was indicated in 36.6% of patients, with an average time to surgery of 24 hours. Only 5/11 patients with a neurosurgical indication were able to undergo surgery at the neurosurgery unit of Fann Hospital. Table II shows the neurosurgical indications and time to treatment.

Table II: Neurosurgery indications and treatment delays

Indications (Brain scan results	Delay
Acute subdural hematoma + Mass effect	16
Left fronto-parietal extra-dural hematoma + Cerebral edema	24
Left fronto-parietal extra-dural hematoma	24
Acute subdural hematoma, temporo-parietal D 10.5 mm + Mass effect on lateral ventricle	24
Subacute left fronto-parieto-occipital extra-dural hematoma measuring 17.6 mm + Acute HSD blade.	36

The outcome was favorable in 36% of cases (n=11), marked by patient transfer, and unfavorable in 63.34% (n=19), with complications and death.

Complications affected 53.33% of patients and consisted of ventilator-associated pneumonia (33%), pressure ulcers (30%), and urinary tract infections (23%).

Nineteen (19) patients died, representing a mortality rate of 63.34%. The causes of death were septic shock (52.6%), brain herniation (31.6%), and hemorrhagic shock (15.8%).

The mortality rate was higher in patients with a Glasgow score between 3 and 6 (p-value=0.001) and in patients who presented with a pupillary abnormality on admission (p-value=0.002).

The average length of stay was 9.77 days ± 12.02, with extremes of 1 hour and 58 days. In our series, the majority of patients were hospitalized for between 1 and 10 days, i.e., 70% (n=21).

Poor prognostic factors on admission were a Glasgow score between 3 and 6 and the presence of a pupillary abnormality.

DISCUSSION

Traumatic brain injury is a major public health problem [5]. In our study, the frequency of severe TBI was 5.1%. This low incidence can be explained by the absence of a neurosurgery department at Dalal Jamm Hospital, with the majority of TBI cases being redirected to appropriate hospital facilities. The majority of our patients were young people aged between 15 and 30, accounting for 47% of the total, with an average age of 21.98. Zemani found the average age to be 23.22 [6].

This high frequency of traumatic brain injuries in young people can be explained by the fact that they are more exposed to road accidents due to their professional activity as motorcycle drivers, the lack of helmet use, but also their inexperience in driving and failure to comply with traffic regulations. We noted a male predominance (83%) with a sex ratio of 5. Several authors have reported this male predominance with a sex ratio of three to four men for every woman [5-8]. This male predominance may be due in part to men's economic activity and ownership of two-wheeled vehicles. The main cause of TBI in our series was road traffic accidents (63%), followed by falls (work-related and recreational) with a rate of 26%. Souaré, Mariam, and Monkessa reported that road traffic accidents were more frequent in adults in two-thirds of cases [9-11]. In our study, the increase in road traffic accidents is thought to be due to the frequent use of two-wheeled vehicles as a means of transport in the Dakar region, combined with a failure to wear helmets. It is also thought to be due to the poor condition of vehicles, speeding, poor road conditions, and failure to comply with traffic regulations.

The majority of patients had received non-medical transport (83%). The lack of prehospital medical care is a determining factor in mortality in many countries [12-14]. The average time taken for patients to be admitted to intensive care was 2.39 hours ± 1.08, ranging from 30 minutes to 96 hours. All authors agree that any serious TBI must be treated within the first few hours to prevent secondary systemic brain damage (SSBD), which is life-threatening [4]. In our study, the average Glasgow score was 7.2 ± 1.21, ranging from 3 to 8. The majority (60%) had a GCS between 7 and 8. There was a statistically significant correlation between the initial Glasgow score and mortality (p-value=0.001). Anisocoria on admission was present in 13 patients (43%) and bilateral mydriasis in 3 patients (10%). We noted 3 patients (10%) who had motor deficits. Diallo found data similar to our results, with 54.7% of patients presenting with pupillary abnormalities and 10.6% with motor deficits [15]. There was a statistically significant correlation between pupillary abnormalities on admission and mortality (p-value=0.002).

In our series, cerebral edema-hemorrhagic contusions were the most common lesions (33%), followed by depressed fractures (23%) and subarachnoid hemorrhage (20%). Diallo and Charani found that 69% and 67% of patients, respectively, had cerebral contusions [15, 16].

Our results can be explained by the time between the CT scan and the TBI, which plays an important role in the appearance of the images. The images obtained on CT scan depend on the extent of hemorrhage, ischemia, and edema. All of our patients were intubated with an average intubation time of 2 hours ± 0.83, ranging from 1 to 4 hours. Sedation was mainly achieved with midazolam in 83.4% of patients, while thiopental was used in only 16.6% of patients.

In addition to the hypnotic, she also used a morphine derivative, fentanyl, in all sedated patients. The

average duration of sedation was 4.56 days ± 3.96, with extremes ranging from 1 to 17 days.

In Diallo's study, diazepam in combination with fentanyl was the most commonly used, followed by midazolam and thiopental. Patients were sedated for an average of 3 days [15].

Sedation must be administered early as it is an integral part of the brain protection chain.

It is the first therapeutic measure aimed at controlling ICP because it serves several purposes: combating any nociceptive stimuli that could aggravate ICP during care (tracheal suction, nursing, mobilization, painful procedures), adapting mechanical ventilation (PaCO2) to optimize cerebral blood flow, reducing cerebral oxygen consumption to restore an optimal balance between supply and demand, preventing or treating seizures, and potentially combating cortical spreading depression [17]. It is effective in preventing episodes of ICH in 70-80% of patients with severe head trauma [18]. The 2018 recommendations on sedation-analgesia in general intensive care did not address the specific aspects of neurosedation due to a lack of specific studies on the subject [19].

However, its use should only be considered after assessment of vital signs and initial neurological evaluation. In our study, 7 patients (23.3%) received osmotherapy with 10% mannitol during hospitalization due to clinical signs of ICH or brain herniation, or a significant mass effect on brain CT scan. Osmotherapy also reduces CSF volume in the specific case of mannitol. Mannitol reduces CSF secretion more than it reduces CSF reabsorption. Due to its rapid effect on intracranial hypertension (ICH) and beneficial effect on ICP, it is the emergency treatment of choice for intracranial hypertension in patients with signs of brain herniation (areactive mydriasis, anisocoria) and/or neurological deterioration not attributable to a systemic cause, including in the prehospital setting [20].

Our results are similar to those of Diallo and Boudhir, who found that 10% mannitol was administered in 17% and 16.2% of cases, respectively [15-21].

In our study, only 5/11 patients with an indication for surgery underwent surgery, representing a rate of 45.45%. The average time to neurosurgical intervention was 24 hours, ranging from 16 to 36 hours.

Six (6) patients (20%) with an established surgical indication were brain dead before surgery due to the lack of a neurosurgery unit at the hospital. In our series, 11 patients (36%) had a favorable outcome.

Tanapo and Errai reported favorable outcomes in 54.1% and 57.8% of cases, respectively [22, 23]. This difference could be explained by the lack of a neurosurgery unit for early surgical treatment of patients. Surgery is actually rarely performed in the acute phase, but it has a direct impact on the prognosis. The time between the trauma and the evacuation of a hematoma in patients with herniation syndrome is crucial [24].

The average length of stay was 9.77 days ± 12.02, with extremes of 1 hour and 58 days. In the studies by Diallo and Boudhir, the average length of hospital stay was 11.10 days with extremes of 30 minutes and 106 days, and 11.5 days with extremes of 1 hour and 40 days, respectively [15-21].

In our study, complications were found in 16 patients (53.33%). The most common were respiratory complications (33%), followed by pressure ulcers (bedsores) (30%) and urinary tract infections (23%). Boudhir noted a predominance of neurological (24.89%), infectious (20.83%), and respiratory (10.41%) complications [21]. The same is true for the studies by Diallo and Charani [15, 16].

The frequency of pulmonary infections could be explained, on the one hand, by contamination during the manipulation of the endotracheal tube and bronchial suctioning maneuvers and, on the other hand, by insufficient humidification of the inspired air, which impairs mucociliary function and promotes bronchial congestion [25].

In the context of multimodal prevention of healthcare-associated pneumonia, priority should be given to a combination of measures that have an effect on patient morbidity, in particular subglottic suctioning (every 6 to 8 hours) using a suitable endotracheal tube, reducing the duration of mechanical ventilation, hospitalization in intensive care, and antibiotic consumption [26].

The mortality rate in our study was 63.34%. This mortality rate is higher than that reported by Tanapo and Errai, who found rates of 39.8% and 42.22% respectively [18, 19].

The mortality rate observed in our study could be explained by a delay in surgical treatment and the severity of the injuries observed in patients.

The most common causes of death in our study were septic shock in 10 cases (52.6%), followed by brain herniation in 6 cases (31.6%) and hemorrhagic shock in 3 cases (15.8%). The main complication in our study, septic shock, is secondary to ALVIs accompanying prolonged intubation related to severe TBI. Alingrin *et al*., have identified several risk factors associated with the onset of septic shock: age, IGS2 on admission, use of catecholamines in the first 24 hours, length of stay in intensive care, number of days of exposure to an arterial catheter, number of days of exposure to a central venous

line, and number of days of exposure to a urinary catheter [27].

CONCLUSION

TBI is a condition with a high mortality rate in intensive care. It affects young, active males more than others. Treatment must be early to improve the prognosis. Prevention involves raising awareness among young motorcyclists about road safety rules.

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Cite this article: Ndiaye APN, Gaye I, BA EB, Barboza D, Bah F, Ndiaye B, Leye PA, Bèye MD (2025). Management of Severe Head Injuries in the Intensive Care Unit at Dalal Jamm National Hospital. *EAS J Anesthesiol Crit Care, 7*(5), 126-130.