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Review of adult head injury admissions into the intensive care unit of a tertiary hospital in Nigeria

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Abstract

Background: ***Head injury is frequently associated with death and disability and imposes considerable demands on health services. Outcome after head injury is closely related to prompt management, including prevention of secondary brain injury and intensive care unit (ICU) management. This study aimed at determining the aetiological spectrum, injury characteristics, ICU admission patterns, and treatment outcomes of adult head-injured patients at a sub-Saharan tertiary hospital.***

Methods: ***A retrospective study on adult head-injured patients admitted to the ICU of a sub-Saharan tertiary hospital between July 2000 and June 2010.***

Results: ***A total of 198 head-injured adult patients were managed in the ICU during the study period. This included 128 males and 70 females with a male-to-female ratio of 1.8:1. The most common mode of injury was road traffic accident. All the patients admitted to ICU had either moderate or severe head injury, with 73.7% having severe head injury. About 26.3% of the patients had associated cervical spine injuries and 50% had various musculoskeletal and soft tissue injuries. Cranial computed tomography findings included brain contusions and intracranial haematomas. Mean duration of ICU stay was 18 days (range 24 hours-42 days), with 89.9% discharged out of ICU care. The overall mortality was 10.1%, although only 36.9% had satisfactory outcomes, as determined by the Glasgow Outcome Scale. Outcome had statistically significant ($P < 0.05$) relationship with severity of head injury and surgical intervention.***

Conclusions: ***Head injury management in the ICU requires an approach to ensure prevention of secondary brain injury; appropriate and early neuroimaging to diagnose lesions that would benefit from timely surgical intervention; as well as management of fluid, electrolyte and haematological derangements.***

Keywords: head injury, admissions, ICU

Introduction

Head injury is a major public health problem worldwide, and it is associated with high morbidity and mortality both in developed and developing countries.[1-5] In developing countries, injuries in general, and head injuries in particular, are on the increase owing to high rates of urbanisation, motorisation, violence, wars, and crimes.[6] The causes and pattern of head injuries reported in the literature tend to vary from 1 part of the world to another because of variations in infrastructure, civil violence, wars, and crime.[7] Road traffic accidents (RTA) are the most common cause of head injuries, accounting for up to 70% in some series, especially in teenagers and young adults.[8,9] Falls are also contributory and are more common at the extremes of age. Head injuries are often associated with other extra-cranial injuries.[7,8]

The first intensive care unit (ICU) was reported to have started at the Kommunehospitalet Copenhagen in 1953 by Dr Bjorn Ibsen, who made a remarkable contribution to the 1952 polio epidemic by realising that patients were dying from respiratory failure and not overwhelming viral infection.[10,11] ICUs have since evolved from postoperative care wards or recovery rooms to interdisciplinary units that care for critically ill patients, including head-injured patients.

The management of patients with head injury requires a coordinated, comprehensive, and multidisciplinary approach whose goal is prevention of secondary brain injury by avoiding hypotension and cerebral hypoxia and other aggravating factors. Early recognition and prompt treatment of surgical intracranial lesions along with prompt treatment of associated extra-cranial injuries are essential for optimal patient outcomes.[9] A proper understanding of the aetiological factors, injury patterns, treatment plans and protocols, ICU management, and outcomes of these patients is essential for establishment of preventive strategies as well as treatment protocols. There is a dearth of such data in our environment.

The objective of this study was to review the aetiological spectrum, injury patterns, ICU management, and outcomes of head injuries in our setting. The study will provide a basis for planning of care and establishment of treatment protocols.

Methods

This was a retrospective study carried out on all head-injured adults admitted to ICU for neuro-intensive care in a sub-Saharan tertiary hospital over a period of 10 years, spanning from July 2000 to June 2010. All adult patients who were admitted into the ICU for the management of traumatic brain injury were included in the study. Ethical clearance was obtained from the institution's ethical committee. Information was obtained from admission and discharge records and patients' case files.

Data obtained included age, gender, severity of head injury, associated injuries, packed cell volume (PCV) at presentation, plasma electrolytes, urea and creatinine at presentation, duration of ICU stay, and outcome. Based on the Glasgow Coma Scale (GCS), the severity of head injury was grouped into moderate (9/15 to 12/15) and severe (3/15 to 8/15).[10] Haematologic and biochemical investigations at presentation were noted and included PCV and plasma electrolytes, urea, and creatinine. Results of computed tomography (CT) scans of the brain were also noted for all the cases. Based on the neurologic status and status of the associated injuries, patients were managed either conservatively or surgically following initial resuscitation at the accidents and emergency unit of the hospital. Indications for surgery were individualised, based on cranial CT features of any operable lesion. All patients with a GCS of 10/15 or less, respiratory distress, or shock were intubated or ventilated. Tracheostomy was performed where there was prolonged intubation or ventilation (> 7 days) and in cases of severe facial injuries. Neurologic outcome was assessed at death or after 3 months (for patients who survived) using the Glasgow Outcome Score (GOS).[11]

All statistical analyses were carried out using SPSS version 20. Continuous variables were expressed as mean ± standard deviation (SD).

Results

During the study period, a total 198 adult head-injured patients were admitted to the ICU for neuro-intensive management. This constituted 15.7% of all ICU admissions during the study period.

There were a total 128 (64.6%) males and 70 (35.4%) females, with a male-to-female ratio of 1.8:1. The most common age group involved was 18 to 40 years (60.6%). The 41- to 60-year age group made up 27.3% of the patients were, and only 12.1% of the patients were above 60 years. The most common presentation was loss of consciousness (76% of patients); 37% of these patients also presented with seizures. Modes of injury are as presented in Table 1. There were 146 cases (73.7%) of severe head injury and 52 cases (26.3%) of moderate head injury during the study period. The most common associated injuries included musculoskeletal soft tissue injuries (50%), long bone fractures (34.3%), facial injuries (27.7%), and cervical spine injuries (26.3%), as shown in Table 2.

Table 1: Modes of injury

Mode of injury	n	%
Road traffic injuries	152	76.8
Falls from heights	25	12.6
Assaults	10	5.1
Collapsed building	8	4.0
Falling objects	3	1.5

Table 2: Associated injuries

Injury type	n	%
Musculoskeletal soft tissue injuries	99	50.0
Long bone fractures	68	34.3
Ocular injuries	60	30.3
Facial injuries	55	27.7
Cervical spine injuries	52	26.3
Blunt chest trauma	36	18.1
Blunt abdominal injuries	14	7.1

Table 3: Pattern of injuries on cranial computed tomography (CT) scan

Pattern of injury	n	%
Brain contusion	144	72.7
Subdural haematoma	65	32.8
Depressed skull fracture	54	27.3
Cerebral oedema	46	23.2
Epidural haematoma	16	23.2
Diffuse axonal injury	10	5.1

The patterns of injuries noted on cranial computed tomography (CT) scan are as stated in Table 3. One hundred seventy-six patients (88.9%) underwent endotracheal intubation and 87 patients (43.9%) were mechanically ventilated. The most common neurosurgical procedure was craniotomy and clot evacuation, which was carried out for 65 patients (32.8%). Twenty-four patients underwent tracheostomy to prevent prolongation of endotracheal intubation (Table 4). Blood transfusions were carried out in the ICU for 62 patients (31.3%). Indications for transfusion were mainly haemorrhagic shock at admission and postsurgical anaemia. The duration of ICU admission was less than 1 week in 35 patients (17.7%), 1 week to 9 months in 151 patients (76.3%), and greater than 1 month in 12 patients (6.1%). The mean duration of ICU stay was 18 days. Twenty patients (10.1%) died, 58 patients (23.9%) were in a persistent vegetative state, 12 patients (6.1%) were severely disabled, 35 patients (17.7%) were moderately disabled, and 73 patients (36.9%) had good outcomes.

Table 4: Procedures

Procedure	n	%
ICU procedure		
Endotracheal intubation	176	88.9
Mechanical ventilation	87	43.9
Non-neurosurgical		
Venous cut-down	62	31.3
Tracheostomy	24	12.1
Chest tube insertion	16	8.1
Neurosurgical		
Craniotomy and evacuation of haematomas	65	32.8
Elevation of depressed skull fracture	54	27.3
Exploratory burr hole	16	8.1
Decompressive craniectomy	13	6.6

The influences of various factors on neurological outcome are shown in Table 5. Admission pulse rate and systolic blood pressure had a statistically significant ($P < 0.001$) relationship with the outcomes of treatment. Admission PCV was also statistically significantly associated with outcomes of ICU care. Abnormal levels of admission plasma sodium and potassium were also noted in some of the patients. Incidence of either of these electrolyte imbalances was significant statistically in relation to the outcomes of management. Mechanical ventilation, surgical management, and severity of the head injury had statistically significant relationships with mortality (P < 0.05) (Table 6).

Table 5: Relationship between clinical investigation results and outcomes

Investigation	Result	Glasgow Outcome Score 1	2	3	4	5	P-value
Pulse rate (per min)	< 60	4	11	3	-	-	< 0.001
	> 60	-	2	2	5	18	
SBP (mmHg)	< 90	4	8	1	-	1	< 0.001
	> 90	2	9	1	5	12	
PCV (%)	< 30	6	9	-	-	2	< 0.005
	> 30	-	-	-	1	15	
Na^+ (mmol/L)	< 120	1	7	2	1	-	< 0.005
	120-140	-	2	-	7	5	
	> 140	2	4	-	-	-	
K^+ (mmol/L)	< 3	-	1	2	3	1	< 0.005
	3-5	-	-	1	6	16	
	> 5	1	5	-	-	3	
Total	198	20	58	12	35	73	

SBP = systolic blood pressure; PCV = packed cell volume

Table 6: Relationship between management or severity of head injury and mortality

Management	Outcome: Died (%)	Survived (%)	P-value
Mechanical ventilation	13 (14.9)	74 (85.1)	0.045
No mechanical ventilation	7 (6.3)	104 (93.7)	
Surgical management	8 (6.1)	123 (93.9)	0.009
Non-surgical management	12 (59.7)	55 (40.3)	
Severity			
Moderate head injury	1 (1.9)	51 (98.1)	0.023
Severe head injury	19 (13.0)	127 (87.0)	

Discussion

This study showed that among the 198 head-injured patients managed in the ICU over the review period, mortality was 10.1% (20 patients). However, only 73 patients (36.9%) had good outcomes (indicated by their ability to return to pre-injury activities or occupations). One hundred five patients (47.7%) had disabilities ranging from moderate to severe vegetative state. Pre-hospital management is among the factors that have been identified in the literature as crucial in the prevention of secondary brain injury.[13,14] The lack of effective pre-hospital management in our setting may account for the high morbidity associated with patients with head injuries managed in our ICU and practice environment.

The majority of patients with traumatic brain injury in this review were males of an active age group. This is similar to what has been reported in the literature, as people of this age (especially males) are more mobile, go out for work, and take risks, while elderly population and females are usually less aggressive and adventurous.[14,15] This has grave consequences for the economy of the country, owing to the loss of contributors to the working population.

Initial GCS denoted the severity of head injury in the patients studied. Severe head injury with lower GCS, compared to moderate head injury, can result from greater force and extent of brain injury and possibly decreased brain perfusion, which could be partly related to initial inadequate resuscitation.

Patients in the present study admitted with systolic blood pressure less than 90 mmHg had worse outcomes. Despite the limitations of our trauma care system and resources, mortality among traumatic brain injury patients can be reduced if from the site of injury to the ICU, haemodynamic stability is maintained (diastolic blood pressure > 70 mmHg and systolic BP > 90 mmHg) at all times.[12] The presence of bradycardia at presentation (which could indicate the late stages of raised intracranial pressure) was also associated with worse outcomes. Patients who had anaemia at presentation in the ICU were also noted to have poorer outcomes than those who did not. This could reflect the presence or severity of the associated injuries as well as the impact of anaemia on cerebral blood flow and cerebral perfusion.

In this study, we found that the patients presenting with abnormal levels of plasma sodium and potassium had significantly worse outcome on the GOS compared to those who had normal plasma potassium levels. There were 3 deaths among patients who had deranged plasma sodium; no patients with deranged plasma sodium experienced good recovery. In the setting of head injury, the incidence of significant fluid and electrolyte imbalance increases with the severity of injury. Studies that have investigated the clinical significance of post-traumatic derangement in plasma levels of potassium have concluded that it is directly associated with or indicates a poorer outcome.[8,14] Also, the occurrence of plasma sodium derangement in head-injured patients has been found to impact significantly on outcome of management.[15]

The pattern of injuries on cranial CT scan included mostly brain contusions, although many of these patients had concomitant intracranial haematomas, which were surgically evacuated. Elevation of depressed skull fracture was done in 27.3% of patients. Surgical management, in patients for whom cranial CT findings showed lesions amenable to surgery, reduced mortality and this was statistically significant. Likewise, patients with less severe injuries at presentation had statistically significantly lower mortality. This is similar to what has previously been reported elsewhere.[13,14]

Patients who were mechanically ventilated had a higher mortality than those who were not ventilated. This observation of increased mortality in mechanically ventilated patients may be a reflection of the severity of head injury or other injuries in patients requiring mechanical ventilation in our setting.

Conclusions

Traumatic brain injury is a serious public health problem worldwide. Traumatic brain injuries contribute to a substantial number of deaths and cases of permanent disability. Management of head injuries in intensive care can be challenging, especially in resource-poor settings such as ours. With the proper support, therapy, and definitive surgical management where indicated, the mortality and morbidity associated with traumatic brain injury can be decreased.

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