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Admissions and outcomes of intensive care management of severe head injured patients in non-neurosurgical centres

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Abstract: Background: The admissions and outcomes of intensive care management of severe head injured patients depend not only on the standard and effectiveness of the treatment obtained but also on the available technical and human resources. We aimed at auditing the admissions and indeed the outcomes of severe head injured patients admitted in our non-neurosurogical centres. Patients and Methods: This was a retrospective review of the demographic, clinical with neurological data and outcomes of the management of all severely head injured patients admitted to the Intensive Care Units (ICU) of the Federal Teaching Hospital, Gombe and University of Maiduguri Teaching Hospital, Nigeria, for three year duration from January, 2007- December, 2009. Results: The total of 258 cases were retrieved and analyzed within the period under review. Two hundred and thirty one (n=231, 89.53%) were males and twenty seven (n=27, 10.47%) were females. The ages ranges between 1-70 years old with the mean ages of 31.29 (SD=15.66). The length of stay (LOS) from admission to discharge ranged from 1-29 days with the mean of 5.80 days (SD= 6.06) while, the LOS from admission to death ranged from 1-24 days with the mean of 3.62days (SD=4.14). Majority (91.8%) of the causes of the head injury were due to RTA with the mortality rates of 27.9%. Conclusions: A well equipped ICU would greatly facilitate the care of the severely head injured patients and can be an achievable goal in developing countries, if there is rational allocation of resources despite the prevailing challenges. We therefore, recommend the establishment of ICU in general and to encourage physicians to develop interest in the management of severely head injured patients even in a non-neurosurgical ICU.

Keywords: Admissions, Outcomes, Severe Head Injury, Management, Non-Surgical ICU

1. Introduction

Severe head injury, which is defined as severe traumatic brain injury associated with a Glasgow Coma Scale (GCS) score of 3 to 8, [1] is a major and challenging problem in the intensive care medicine. Over the years there are remarkable progresses in the intensive care management of severe head injury. In 1996, the Brain Trauma Foundation (BTF) published the first guidelines on the management of severe traumatic brain injury (TBI) [2] that was accepted by the American Association of Neurological Surgeons and endorsed by the World Health Organization committee on Neuro-traumatology. The second edition was reversed in 2000 [3] with an update in 2003, and the 3rd edition was published in 2007. [4] Several studies have reported the impact of implementation of guidelines –based management protocols for severe TBI on patient's treatment and outcome. [5] It is associated with substantially better outcomes such as mortality rate, functional outcome scores, length of hospital stay and costs. [6] However, there is still considerable and wide institutional variations in the care of patients with severe TBI.

Head injury is associated with tremendous morbidity and mortality. One percent of all deaths in the UK are attributed to head injury; up to 85% of all severely head-injured patients remain disabled after 1 year and only 15% of patients returned to work at 5 years. [7]

Head injury is divided into injury to the scalp, skull and brain, it is further subdivided into primary and secondary brain injury. Primary injury refers to the initial injury, while secondary injury refers to factors which exacerbate the primary injury at the time of trauma, either as localised (contusion or laceration) or generalised as in concussion and shearing of nerve fibres in the white matter after the injury has occurred.[6] The principles of management of severe head injury are aimed at preventing or at least minimising the secondary injury.

The impact of patient characteristics including demographics, Glasgow Coma Scale and day/time of admission to the intensive care unit on outcome of neurosurgical patients has been investigated by some authors [8] Establishing a dedicated neurosurgical intensive care was shown to improve clinical outcomes in severely head injured patients.[9] In this study therefore, we aimed at auditing the admissions and outcomes of the management of severely head injured patients in our non-neurological intensive care units.

2. Patients and Methods

This was a retrospective review of the demographic, clinical and the neurological data of all severely head injured patients admitted to the Intensive Care Units (ICU) of the Federal Teaching Hospital, Gombe and University of Maiduguri Teaching Hospital, Nigeria, for three year duration from January, 2007- December, 2009. We retrieved records of all patients managed in the units over the period under review. Records of neurosurgical patients were selected for detailed analysis. Their characteristics including age, gender, GCS on admission to ICU, diagnosis, length of stay (LOS), ICU intervention and the outcome of the management were collated and analysed. Patients who were repeatedly admitted to the ICU and those whose data were incomplete were excluded from the analysis.

In patients with clinical evidence of raised intracranial pressure, pharmacological decompression was achieved with mannitol and frusemide, and sometimes with intubation, mechanical ventilation with hyperventilation using propofol and/or midazolam sedation. Surgical intervention was offered during the second half of the period when clinically and/or radiologically indicated.

Data were analyzed using Epi-Info™ 7. The results were presented in tables as frequency and percentages. The association between clinical variables and outcomes were tested using Chi square test. The level of significance is set at a probability of 0.05.

3. Results

The total of 258 cases were retrieved and analyzed within the period under review. Two hundred and thirty one (n=231, 89.53%) were males and twenty seven (n=27, 10.47%) were females, with M: F ratio of 8.6:1. The ages ranges between 1-70 years old with the mean ages of 31.29 (SD=15.66). The demographic characteristic of the patients (age and genders distribution) are shown in Table I.

Table I. *Age and genders distribution of patients.*

Ages (yrs)	Males	Females	Total	(%)
1-10	24	3	27	10.47
11-20	31	5	36	13.95
21-30	78	4	82	31.78
31-40	39	3	42	16.28
41-50	29	4	33	12.79
51-60	22	5	27	10.47
61-70	8	3	11	4.26
Total	231(89.53%)	27(10.47%)	258	100

The length of stay (LOS) from admission to discharge ranged from 1-29 days with the mean of 5.80 days (SD= 6.06) while, the LOS from admission to death ranged from 1-24 days with the mean of 3.62days (SD=4.14).

Table II. *Traumatic Brain Injury (TBI) according to the causes.*

Causes	Patients	Percentages
TBI due to RTA	237	91.86
TBI due to Assault	9	3.49
TBI due to fall from height	6	2.33
TBI due to gunshot	6	2.33
Total	258	100

Table III. *Significance of the effects of therapeutic interventions on the outcomes of TBI.*

Intervention	Patients	Discharge (%)	Deaths (%)	P	X^2
Surgical interventions	60	39(65)	21(35)	0.000	4.56
Endotracheal intubation	81	68(84)	13(16)	0.023	5.16
Without ventilation					
Mechanical ventilation	141	93(66)	48(34)	0.907	0.013
Medical decompression	238	181(76)	57(24)	0.227	1.466
Tracheostomy	10	7(70)	3(30)	0.228	1.454
Chest tube insertion	15	9(60)	6(40)	0.173	1.858

Table IV. *Outcomes of the severe head injured patients according to the GCS.*

GCS	At Admission	At Discharge	At referral	During Death
8	66(25.58%)	93(53.45%)	0	0
7	54(20.93%)	21(12.07%)	0	0
6	37(14.34%)	12(6.89%)	3	0
5	44(17.05%)	18(10.34%)	8	12
4	27(10.47%)	16(9.19%	0	24
3	30(11.63%)	14(8.05%)	0	36
Total	258(100%)	174(100%)	14	72

The mortality rate of severe head injured patients in our centres was 27.9% for the period under review.

4. Discussions

This study shows that majority of the patients that were admitted into our ICU were males made up of 89.53% and the ages between 21-30 years which belong to the most active and productive age groups. Girling K[10] reported in his studies that a bimodal age distribution exists, with young adults (15-29 years) and the elderly most commonly suffering head injury which is similar to our findings. Similarly, he reported that men are more than twice as likely to suffer head injuries compared to women; however, we found a very wide difference between the genders as shown in Table I. Marik P et al[11] reported that common causes of head injury include road traffic accidents, fall and assaults which concur with our study which shows that majority of our patients are due to RTA (91.86%) as shown in Table II.

In a study conducted by Adamu et al [12] shows that 30.7% of the ICU patient admissions were due to severe head injury with mortality rate 13.8% which is lower than our observed value of 27.9%, this may be because of their low sample size of 114 patients as against 258 patients in this study. We therefore consider reviewing the admissions and the outcomes of severe head injury in our intensive care units. Although monitoring and targeted management of intracranial pressure (ICP) and central perfusion pressure (CPP) for patients with severe head injury has been advocated by several authors [13, 14] this recommendation is based on the physiologic principles and association of poor outcomes with systemic and cerebral derangements such as arterial and intracranial hypotension, hypoxia and low CPP. However, Cremer OL et al [15] opinioned that the impact of ICP/CPP targeted therapy on outcome are unclear and that it results in prolonged mechanical ventilation which may prolong ICU LOS. In addition, the use of ICP monitoring to guide therapy in the ICU has not been subjected to randomized controlled trial.[14]

A carefully considered fluid strategy is required. The aim is to achieve a balance between maintaining normovolaemia and end-organ perfusion without worsening cerebral oedema through excessive fluid administration. With increased sodium content, 0.9% sodium chloride (Na+ 154 mmol/l) is often used, with careful attention required to avoid causing a hyperchloraemic acidosis. Hypotonic fluids such as 5% dextrose should be avoided. Without an ICP monitor like in our centres the first signs of raised ICP may be "late signs" of hypertension, bradycardia and papillary dilation. If above targets are being achieved and the patient is adequately sedated, non-surgical therapeutic strategies may include the use of osmotherapeutic agents such as mannitol or hypertonic saline, cooling, moderate hyperventilation ($PaCO_2$ 4KPa or 30mmHg) and the use of thiopentone. Both hypoglycaemia and hyperglycaemia can worsen brain injury. Blood glucose of 4-8 mmol/l is targeted. Seizures increase cerebral oxygen consumption and can produce cerebral ischaemia. Seizures should be treated promptly with appropriate anti-epileptic drugs (e.g phenytoin, 18mg/kg). A cerebral metabolic rate is directly related to body temperature, hyperthermia can also increase cerebral oxygen consumption. Hyperthermia, a temperature of greater than 37^{o}C, should be avoided. ICP above 20 mmHg requires urgent treatment. In the absence of ICP monitoring like in our centres, the first indication of intracranial hypertension may be haemodynamic and papillary signs. [16]

Surgical interventions and endotracheal intubations without mechanical ventilation were found to be significantly affected the positive outcomes of the patient management in our ICU, the reasons are not far fetch because all our patients are subjected to detail investigations such as CT- brain, MRI etc before any forms of surgical interventions. The endotracheal intubations without mechanical ventilation was significant because it was usually done in all GCS of 8 and 7 but all patients with GCS of less than 7 were mechanically ventilated and they had high mortality rate as shown table IV.

A good outcome in severe head injury by recommendation of the Royal College of Surgeons of England requires that life saving decompressive surgery be made readily available to all patients who require it within 4 hours of the injury. In our setting and similar to what is obtainable in many Africa settings, adequate pre-hospital care is virtually non-existent and there is always a delay in evacuation of patients to the hospitals making the above recommendation practically infeasible. A better outcome will therefore require a well structured trauma care system involving a well coordinated evacuation and pre-hospital care, prompt resuscitation of patients and rapid evaluation inclusive of CT-scanning, early decompressive surgery and an efficient hospital referral system to major Neurosurgical centres when necessary. Above all, such Neurological centres should be readily accessible. Compared with other studies with constraints in ventilating their head injury patients, most of our severely head injured patients were mechanically ventilated with a goal of maintaining $PaCO_2$ at 30 mmHg and PaO_2 greater than 80 mmHg.[17] Our findings may not apply to institutions in the western world but in the developing world because of small sample size, and poor personnel, materials and technical resources. However, the findings have identified the need to develop the ICU and to encourage for further training in the management of severe head injured patients in our region.

5. Conclusion

A well equipped ICU which greatly facilitates the care of the severely head injured patients is a desirable, relevant and vital component that leads to a successful practice in the developing countries. Such modern and innovative intensive care is a feasible and achievable goal in developing countries if there is rational allocation of

resources despite the prevailing challenges in these countries. We therefore, recommend the establishment of ICU in general and to encourage physicians to develop the interest in the management of severely head injured patients even in a non-neurosurgical ICU.

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