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Intensive care unit deaths among neurosurgery patients in a tertiary hospital in South Western Nigeria

***Rabiu TB[1,2], Uthman II[1], Folami EO[2,3]**

Abstract

Background: Neurosurgical patients are the most critical ICU admissions. While advancements in neurosurgical ICUs (NICU) have improved outcomes of care globally, ICU mortality remains a major clinical issue in developing nations. This study evaluates ICU mortalities of neurosurgical patients in a general ICU setting at the UNIOSUN Teaching Hospital, Osogbo, Nigeria.

Method: Case records of neurosurgery patients who died in the ICU of UNIOSUN Teaching Hospital, Osogbo, South-Western, Nigeria from June 2012 to May 2022 were reviewed. Simple descriptive statistics of data on demographics, clinical diagnoses, management and outcome were done.

Results: Mortality rate was 38.9% (84 of 216 admissions). Males were 67(79.8%) and the mean age was 41.5years (Range: 2-85years). The average duration of ICU stay was 3.5days (Range: 30minutes-20days). Most patients had severe traumatic brain injury (TBI) (62, 73.8%). This was followed by cerebrovascular diseases (12, 14.3%) and brain tumours (6, 7.1%). Two had brain abscess. One patient each had mixed subacute/chronic subdural haematoma and severe cervical spondylotic myelopathy. Of the 69 whose case files were found, 7(10.1%) had a diagnosis of brainstem death before eventual 'final' death after an average of 13.5 additional hours on mechanical life support. The identified secondary causes of death included raised ICP, sepsis, primary surgical haemorrhage, seizures, acute kidney injury, malignant hypertension, poor glycaemic control and aggressive blood pressure lowering. Only 1 patient had autopsy.

Conclusion: Most ICU mortalities among neurosurgical patients were from severe TBI. The establishment of NICU is necessary to improve outcome of care of neurosurgical patients.

Key Words: Neurosurgery Deaths; ICU Mortality; Nigeria; Neurosurgery

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Décès en unité de soins intensifs parmi les patients en neurochirurgie dans un hôpital tertiaire, au sud-ouest du Nigéria

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Resume

Contexte général de l'étude: Les patients en neurochirurgie sont les admissions les plus critiques en USI. Alors que les progrès réalisés dans les USI neurochirurgicales (USIN) ont amélioré les résultats des soins à l'échelle mondiale, la mortalité en USI reste un problème clinique majeur dans les pays en développement. Cette étude évalue les mortalités en soins intensifs des patients neurochirurgicaux dans un cadre général de soins intensifs à l'hôpital universitaire UNIOSUN, Osogbo, Nigeria.

Méthode de l'étude: Les dossiers de patients en neurochirurgie décédés à l'unité de soins intensifs de l'hôpital universitaire UNIOSUN, Osogbo , sud -ouest, Nigéria de juin 2012 à mai 2022 ont été examinés. Des statistiques descriptives simples de données sur la démographie, les diagnostics cliniques, la prise en charge et les résultats ont été réalisées.

Résultat de l'étude : Le taux de mortalité était de 38,9 % (84 admissions sur 216). Les hommes étaient au nombre de 67 (79,8 %) et l'âge moyen était de 41,5 ans (intervalle : 2-85 ans). La durée moyenne de séjour en soins intensifs était de 3,5 jours (fourchette : 30 minutes à 20 jours). La plupart des patients avaient un traumatisme crânien grave (TCC) (62 ; 73,8 %). Viennent ensuite les maladies cérébrovasculaires (12, 14,3 %) et les tumeurs cérébrales (6, 7,1 %). Deux avaient un abcès cérébral. Un patient avait chacun un hématome sous-dural mixte subaigu /chronique et une myélopathie spondylotique cervicale sévère . Sur les 69 dont les dossiers ont été retrouvés, 7 (10,1 %) avaient reçu un diagnostic de mort du tronc cérébral avant la mort « définitive » après une moyenne de 13,5 heures supplémentaires sous assistance mécanique. Les causes secondaires de décès identifiées comprenaient une PIC élevée, une septicémie, une hémorragie chirurgicale primaire , des convulsions, une lésion rénale aiguë, une hypertension maligne, un mauvais contrôle glycémique et une baisse agressive de la pression artérielle. Un seul patient a eu une autopsie.

Conclusion: La plupart des décès en USI chez les patients en neurochirurgie étaient dus à un TCC sévère. La mise en place de l'USIN est nécessaire pour améliorer les résultats des soins des patients neurochirurgicaux.

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INTRODUCTION

Neurocritical patients constitute a large number of intensive care unit (ICU) admissions in most parts of the world (1-4). Of these, neurosurgical patients, especially those with neurotrauma, are among the most critical of all admissions into the ICUs. In order to improve outcomes among neurosurgical patients, neuro-ICUs have been established in many centres in developed countries and neuro-intensivists employed to provide optimal care (1,5,6).

While these advancements have largely resulted in more encouraging trends in survivals and reduction of disabilities among neurosurgical patients in the developed countries, the situation in developing countries is gloomy as health needs are largely beyond what the available resources can cater for (2,7,8). Consequently, the ICU mortality rates in these resource-limited nations have remained considerably high (3,7). Furthermore, the risk of death among post-operative patients in Africa is twice that of the global average largely due to lack of the necessary resources and personnel (9).

There is limited literature on neurosurgical ICU deaths in Africa. Thus, this study evaluates the pattern of death among neurosurgical patients managed at a general ICU in a resource-limited setting in South Western Nigeria.

MATERIALS AND METHOD

A retrospective study of neurosurgery patients who died in the ICU of UNIOSUN Teaching Hospital (formerly LAUTECH Teaching Hospital), Osogbo, South-Western, Nigeria from June 2012 to May 2022 was conducted. The hospital has a general ICU for all patients needing intensive care. The 4-bedded ICU is equipped with 3 ventilators of which none may sometimes be functional. Admissions into the unit are, therefore, competitive mostly on a first-to-come basis leading to delays in ICU admissions even for the most critical of cases. The unit is manned by anaesthetists and mostly general nurses with no intensivist.

Information on demographics, clinical and radiological diagnoses, associated injuries, complication, length of hospital stay and causes of death was retrieved from the ICU admission records and the case files of the identified patients.

Data Management

Simple descriptive statistics of data on demographics, clinical diagnoses, admission characteristics, management and outcome was done with SPSS version 26 (IBM Corp., 2019). All identified cases had analysis of demographics and diagnoses but only those whose case files were found at the medical records units were included in further analysis of the admission characteristics, management and outcome. Descriptive analyses of sizes, frequencies, proportions, measures of central tendency (mean) and measures of dispersion (range) were done. The results are presented in texts and tabular forms.

RESULTS

Of the 1329 ICU admissions, neurosurgical patients were 216 (16.3%). The neurosurgical mortality rate was 38.9% (84 of 216 admissions) which represented 84/470(17.9%) of all ICU deaths during the study period. Only 69 case files were found. (Figure 1)

Demographics: More deaths occurred among males, 67(79.8%). The mean age was 41.5years (Range: 2-85). (Table 1)

Clinical and Radiological Diagnoses: Most patients had severe traumatic brain injury (TBI) (62, 73.8%), of which 51 had complete records. This was followed by cerebrovascular diseases (12, 14.3%) and brain tumours (6, 7.1%). (Table 2). 37(53.6%) had neuro-imaging {computerized tomographic (CT) scan or magnetic resonance imaging (MRI)}. The predominant findings in 19 TBI patients who had CT scans were subarachnoid haemorrhage (9, 47.4%), cerebral contusions (7, 36.8 %), intracerebral haematoma (7, 36,8%), acute extradural haematomas (6, 31.6%) and acute subdural haematoma (6, 31.6 %). Severe pressure effects were demonstrated by midline shifts (16, 84.2%) and effacements of the basal cisterns (6, 31.6%)

Associated Injuries: The predominant associated injuries in TBI patients were skull fractures (24/51, 47.1%) and long bones fractures (13/51, 25.5%). (Table 3)

Laboratory parameters: Deranged laboratory parameters found are presented in Table 4. Anaemia necessitating blood transfusion was noted in 17/60 (28.3%). Of the 36 who had white blood cells counted, 29 had leukocytosis. Hypokalemia occurred in 8 of 46 (17.4%) patients in whom electrolytes were assayed.

Peri-operative Complications and Major Clinical Problems: Twenty six (37.7%) patients

had neurosurgical operations. The observed peri-operative complications included acute kindney injury (AKI), severe primary surgical haemorrhage and intra-operative cardiac arrest. Other major clinical problems included malignant hypertension, brainstem dysfunction and sepsis. (Table 5)

Brainstem Death: A diagnosis of brainstem death was made in 7(10.1%). They were on mechanical life support for an average of 13.5 hours before eventual 'death'. None was taken off mechanical ventilator before cessation of cardiac activities in line with family's preferences.

Length of ICU stay: The average duration of ICU stay was 3.5days (Range: 30minutes-20days). The longer ICU stays were mostly in patients with severe TBI.

Secondary Causes of Death

The identified secondary causes of death were: raised intracranial pressure (ICP) (20, 29.0%), sepsis (3, 4.3%), primary surgical haemorrhage (4, 5.8%), seizures (1, 1.4%), acute kidney injury (6, 8.7%), malignant hypertension (2, 2.9%), poor glycaemic control (2, 2.9%) and aggressive lowering of the blood pressure (2, 2.9%).

Autopsy

Only 1 patient (severe TBI from gun-shot wound) had autopsy. Consent was generally not given and cultural/religious practices made autopsy impossible even though many qualified for coroner's autopsy.

DISCUSSION

This study showed that neurosurgical patients constitute a major portion of ICU admissions in our centre and also contribute a large proportion of ICU deaths. Severe TBI was a leading cause of ICU death in our patients and it was almost exclusively caused by road traffic crashes.

ICU deaths remain a major clinical problem worldwide. This is especially so in developing countries with resource constraints and poorly equipped/manned critical units. While downward trends in ICU mortalities are being observed in some advanced countries, the rates have largely remained same or are increasing in developing nations such as Etiopia, Nigeria and Malawi (8,10-13).

The predominance of traumatic brain injury as a leading cause of ICU deaths among neurological patients as shown in this study has been reported in many studies locally and internationally (4, 14-16). It is important, therefore, to strengthen preventive measures of TBI especially those targeting reduction of road traffic accidents as suggested by Olajumoke et al, Karthigeyan et al and other researchers (4,17-19). Deranged biochemical profiles, sepsis and some of the other abnormal clinical parameters found in our patients have been shown to be responsible for unfavourable outcomes among patients with critical illnesses and in neurosurgical ICU admissions in previous studies including PREDICT – a multicenter metropolitan ICU study in Australia, and by Ramesh et al in a neurosurgical ICU at a tertiary-care university hospital in India (20,21).

A diagnosis of brain death or brain stem death (BSD) was made in a tenth of the patients. This rate is similar to that reported in a Malawian ICU (22). Patients with such diagnosis are potential candidates for organ donation in countries with well-developed organ donation practices (23).We had previously reported that the knowledge of BSD among our population is low and that most relations of neurosurgical patients would not allow organs to be harvested from the patients in the event of a BSD diagnosis (24). Therefore, increasing awareness of BSD in our community is key to improving the availability of organs for transplantation.

The autopsy rate in this study is abysmally low despite the large number of qualified candidates, especially the TBI patients, who should have coroner's autopsy performed. Similar low or zero rate of autopsy has been reported from Nigeria (25).

Limitation: The non-availability of case records for some of the patients highlights a major problem in conducting retrospective studies in our setting with poor record keeping. A future prospective study is likely to address this problem. As all neurosurgical ICU admissions were not included in this study, it was impossible to draw inferences about the determinants of outcomes of ICU admissions in our neurosurgical patients.

CONCLUSION

Most ICU mortalities among neurosurgical patients in our hospital were from severe TBI and these were almost exclusively caused by road traffic crashes. The establishment of a dedicated neurosurgical ICU and strengthening of preventive measures of road

traffic crashes are necessary to improve outcome of care of neurosurgical patients.

Conflict of interest: None

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Table 1: Demographics

	Number	Percentage
Sex Distribution		
Male	67	79.8
Female	17	20.2
Age Distribution (Years)		
0-10	10	11.9
11-20	7	8.3
21-30	9	10.7
31-40	17	20.2
41-50	13	15.5
51-60	8	9.5
61-70	12	14.3
71-80	7	8.4
81-90	1	1.2

Table 2: Clinical Diagnoses

Clinical Diagnosis	Number	Percentage
Tumours	6	7.1
Pituitary Adenoma	(3)	3.6
Craniopharyngioma	(1)	(1.2)
Brainstem Glioma	(1)	(1.2)
Glioblastoma	(1)	(1.2)
Cervical Spondylotic Myelopathy	1	1.2
Trauma	63	75.0
Severe Head Injury	(62)	(73.8)
Road Traffic Accidents	{61}	{72.6}
Gunshot Wound	{1}	{1.2}
Chronic Subdural Haematoma	(1)	(1.2)
Brain Abscess	2	2.4
Cerebrovascular Disease	12	14.3

Table 3: Associated Injuries in TBI Patients

Associated Injury	Number	Percentage
Skull Fractures	**24**	**47.1**
Basal	4	7.8
Calvarial		
Right	12	23.5
Left	4	7.8
Bilateral	4	7.8
Types of Calvarial Skull Fractures		
Linear	21	41.2
Depressed	1	2.0
Comminuted	1	2.0
Multiple	1	2.0
Cervical Spine Injury	**2**	**3.9**
Long Bone Fractures		
Femur	2	3.9
Tibial	11	21.6
Chest Trauma	**3**	**5.9**
Other Fractures		
Clavicle	1	2.0
Colles	1	2.0
Humerus	1	2.0
Radio-ulnar	1	2.0

Table 4: Deranged Laboratory Parameters

Laboratory Parameter	Number of Patients Assayed	Abnormal Finding	Patients with Abnormal Findings	
			N	%
WBC	36	Leucocytosis	29	80.6
PCV	60	Anaemia	17	28.3
Serum Bicarbonate	46	Metabolic Acidosis	11	23.9
Serum Potassium	46	Hypokalaemia	8	17.4
Serum Urea	44	Uremia	17	38.6
Serum Creatinine	25	Elevated Creatinine	8	32.0

Table 5: Peri-operative Complications and Major Clinical Events/Conditions

Complication/Clinical Event	Number of Patients
Major Peri-operative complications	
Acute Kidney Injury	2
Intra-operative cardiac Arrest	1
Severe primary haemorrhage	4
Other Major Clinical Events/Conditions	
Acute Kidney Injury	4
Malignant hypertension	2
Brainstem Death	7
Chronic Kidney Disease	1
Sickle Cell Disease	2
Post-Traumatic Seizure	1
Sepsis	3
Multiple Organ Dysfunction Syndrome	1

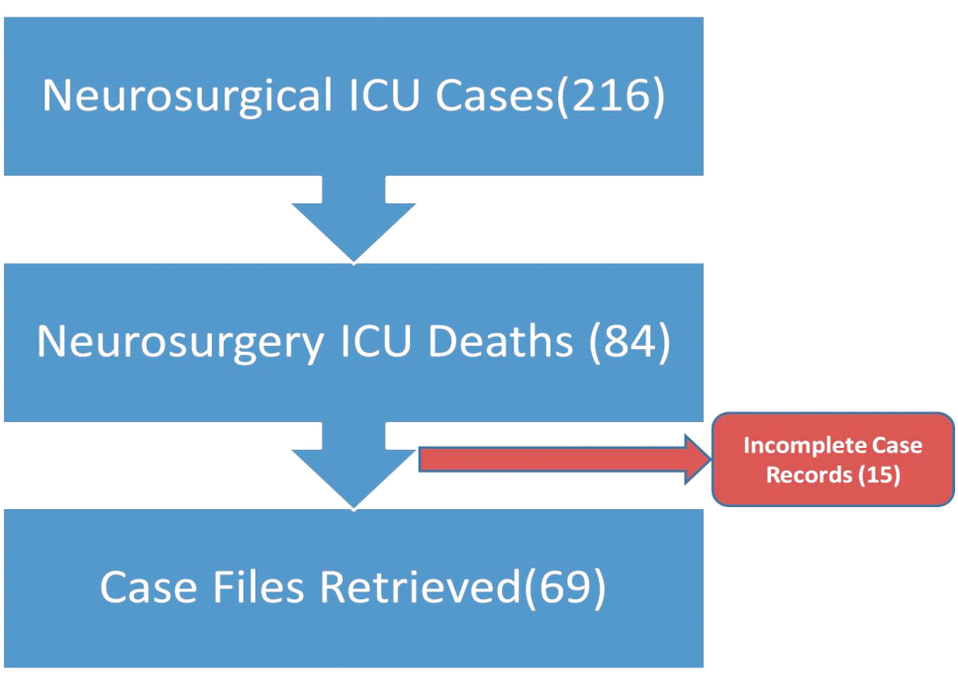

Figure 1: Flow chart for case analysis