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Original Research

Clinical Characteristics and Outcome of Children with Non-Traumatic Coma: Experience from a Tertiary Hospital in Rivers State, Nigeria.

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Abstract

Background: Non-traumatic coma (NTC) is a common neurological emergency associated with high morbidity and mortality. This study investigates the clinical features and outcomes in children at the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Rivers State.

Methodology: A prospective study was conducted from 2021-2023 involving 406 patients who presented with NTC in the children's emergency ward and were consecutively recruited into the study. Consent was obtained from parents/caregivers. Data on age, sex, and clinical history were collected. The aetiology of NTC was determined based on history, clinical examination, and laboratory investigations. The degree of encephalopathy was assessed at presentation using Glasgow's coma score. All patients were followed up until discharge to evaluate the outcome.

Result: A total of 5120 patients aged 1 month to less than 18 years were admitted, with 406 cases of NTC, indicating a prevalence (406/5120) of 7.9%. Of the 406 patients, 194 (47.8%) were males. Their ages ranged from 3 months to 17 years (mean age, 6.13±5.10 years). The prevalence of NTC was higher among under five years old. Fever (76.1%), convulsions (63.8%), and vomiting (53.2%) were the common complaints presented. Two hundred and forty-one (59.4%) patients presented with mild encephalopathy. The primary causes of NTC were CNS infection in 280 (69.0%), metabolic or toxic causes in 44 (10.8%), and epileptic causes in 27 (6.6%). Seventy-one (17.5%) patients died, while 319 (78.6%) were discharged. Among those discharged, 10.0% had mild disability, 3.4% severe disability, and 1.3% remained in a permanent vegetative state. The outcomes were influenced by sex, level of encephalopathy at presentation, age, and the need for ICU care.

Conclusion: NTC is common in children, CNS infections, particularly cerebral malaria and meningitis, were the predominant causes. Implementing measures to prevent these infections is important in our setting, where resources are limited for adequate management.

Keywords: Non-Traumatic Coma; Children; Outcome; Neurological Emergencies; Aetiology; Clinical Characteristics; Paediatrics.

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Quick Response Code:

Introduction

Coma is a common neurological emergency in children that calls for immediate medical attention when a patient arrives at the emergency ward, as it could have a fatal outcome. There are different causes of coma; however, they are typically separated into two main categories: traumatic and non-traumatic.[1] Coma is defined as a state of altered consciousness such that wakefulness and awareness of self and environment are lost. It is a critical condition that requires prompt medical attention. [2,3] A child is said to have a non-traumatic coma (NTC) if the coma occurs without any evidence of trauma.[3]

NTC is a feature associated with various illnesses, including metabolic, toxic, infectious, and epileptic causes. Although traumatic coma has been the primary focus of most epidemiological research in the paediatric population with coma, a major reason for admission to children's emergency wards is non-traumatic coma, which has a high morbidity and mortality rate.[2,4,5] While many children with NTC may achieve complete neurological recovery following treatment, a significant number could experience poorer outcomes that affect their quality of life, and some may even result in mortality.[6,7]

The aetiology as well as the clinical status of the patient at presentation can determine the outcome. In developing countries, coma in children is linked with poorer outcomes and a higher rate of mortality due to poor health-seeking behaviour, out-of-pocket payment, limited resources available to make a diagnosis, and the unavailability of critical care facilities for paediatric patients.[1,3,8,9] Hence, to improve outcomes, clinical features must be recognized quickly to identify the possible aetiologies, make a prompt diagnosis, and institute treatment early to reduce the morbidity and mortality associated with NTC[3,8]. Several studies have evaluated the aetiology, severity, and outcome of NTC among children [8,10,11], but such studies are sparse in our setting. This study aims to examine the aetiology, clinical characteristics, and factors that determined the outcome of children who presented with a non-traumatic coma in the University of Port Harcourt Teaching Hospital.

Methodology

This is a prospective study conducted over 3 years from 2021 - 2023, in the children's emergency ward of the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria. UPTH serves as a referral hospital for both the public and private hospitals in the state and from hospitals in the neighboring states. The children's emergency ward (CHEW)of UPTH is where children aged 1 month to 18 years who present as an emergency are admitted, either on self-referral or following referral from other facilities.

This study was conducted among patients aged 1 month to 18 years admitted to the CHEW of the University of Port Harcourt Teaching Hospital.

The level of consciousness was assessed using the Glasgow Coma Scale (GCS). [12, 13, 14]

Definition of terms:

Coma: An unresponsive state in which the child is not responsive to verbal or sensory stimulation and shows no signs of self or environmental awareness.

For this study, patients whose GCS score was 12 or less for at least 1 hour were in a coma [4, 15,16]. The degree of encephalopathy (DOE) was divided into three categories depending on the GCS level: mild (10-12), moderate (7-9), or severe (3-6) [17].

The outcome of coma: This was categorised into discharged, discharged against medical advice (DAMA), referred, and dead. Among those discharged, they were further classified as normal or with disability. [17,18]

Normal: No motor deficit, ataxia, cranial nerve palsy, and functional level back to pre-illness state.

Mild disability: Negligible changes of tone/deep tendon reflexes, isolated cranial nerve palsy, and weakness or ataxia. Capable of operating at an appropriate age level.

Moderate disability: moderate weakness or ataxia, abnormality in behaviour, and more than one cranial nerve palsy. Requires some assistance with daily activities.

Severe disability: severe weakness or ataxia and quadriplegia. Significant functional impairments; dependent on caregivers for daily activities.

Vegetative: No meaningful response to the environment or ability to interact.

All patients admitted into CHEW who presented in a coma that had lasted for at least 1 hour, with a GCS of 12 or below, were included in the study, provided they had no history of abnormal neurological development, the coma was not due to any traumatic events and patients were not comatose as a result of terminal diseases.

The cause of the coma was identified based on the patient's history, a thorough clinical examination, and relevant investigations. Depending on the individual case, these investigations included neuroimaging (CT scan, MRI, or transfontanelle ultrasound), electroencephalogram (EEG), and laboratory tests such as full blood count with differential, blood cultures, cerebrospinal fluid (CSF) analysis (biochemistry, microscopy, culture and sensitivity), liver function tests, blood glucose levels, and tests for electrolytes, urea, and creatinine.

A proforma form was created that recorded the child's demographic characteristics (age and sex), clinical presentation, GCS, DOE, diagnosis, ICU admission, patient outcome, and degree of disability on discharge. The aetiology of coma was classified into different categories as seen in Table 2.

Data analysis: The collected data was entered into an Excel sheet, coded, and cleaned after which it was transferred to SPSS version 25. Descriptive statistics, such as mean and standard deviation, were performed. Chi-square test and logistic regression were used to determine the association between variables. Ap-value set at < 0.05 was considered statistically significant.

Ethical issues: Informed consent was obtained from the parents/caregivers of each patient in this study; assent could not be obtained as patients were unconscious at presentation. Upon admission, all the patients received appropriate medical care according to their medical condition. Ethical clearance was obtained from the University of Port Harcourt Teaching Hospital Ethical Committee with the code number (UPTH/ADM/90/S.11/VOL.XI/1956).

Result

A total of 5120 children aged 1 month to less than 18 years were admitted into the children's emergency ward from January 2021to December 2023. Within this period, 406 children were admitted for NTC, giving a prevalence (406/5120) of 7.9 %. Of the 406 patients admitted for NTC, 194 (47.8 %) were males while 212 (52.2%) of them were females, giving a male-to-female ratio of 1:1.1. The ages of the patients ranged from 3 months to 17 years, with a mean age of 6.13±5.10 years. The mean age for males was 5.18 ± 4.09 years, while it was 6.08 ± 4.15 years for females. This difference was not statistically significant ($t = 0.223$, $p = 0.99$).

Other than coma, fever (76.1%), convulsion (63.8%), and vomiting (53.2%) were the common presenting complaints.

Concerning the degree of encephalopathy at presentation, 241 (59.4%) of them had mild encephalopathy, 94 (23.1%) had moderate form, and 71 (17.5%) had severe encephalopathy.

One hundred and sixteen (31.4%) of them required intensive care unit (ICU) admission, while 290 (68.6%) of them did not require ICU admission. (Table 1)

Table 1: Demographic, clinical characteristics, degree of disability, and outcome of Paediatric patients with non-traumatic coma.

Variables	Frequency N=406	Percentages (%)
Sex		
Males	194	47.8
Females	212	52.2
Age in years		
< 1	43	10.6
1-<5	178	43.8
5-10	98	24.2
11-< 18	87	21.4
Mean age 6.13 ± 5.10, t = 0.223		
*Clinical presentation	N= 406	
Altered sensorium	406	100.0
Fever	309	76.1
Convulsion	259	63.8
Headache	216	53.2
Vomiting	175	43.1
Abnormal deviation of the eyes	175	43.1
Double vision	170	41.9
Focal neurologic deficit	152	37.4
Neck pain/neck stiffness	150	36.9
Deviation of the mouth	147	36.2
Loss of milestone	143	35.2
Loss of vision	143	35.2
Confusion	63	15.5
Excessive crying	28	6.9
Bulging fontanelle	21	5.2
Changes in personality	16	3.9
Aphasia	14	3.8
Abnormal posture	10	2.5
Degree of encephalopathy at presentation		
Mild (GCS 10-12)	241	59.4

Moderate (GCS 7-9)	94	23.1
Severe (GCS 3-6)	71	17.5
Admitted into ICU		
Yes	116	31.4
No	290	68.6

*** Multiple responses made**

Table 2 shows the aetiology of Coma.

Table 2: Aetiology of coma among children

Causes of coma	Frequency N=406	Percentages
Neuro-infection	**280**	**69.0**
Cerebral malaria	133	47.5
Meningitis/meningoencephalitis	128	45.7
Cerebral abscess	19	6.8
Metabolic /Toxic	**44**	**10.8**
Diabetes Mellitus	5	11.4
Diarrhoea disease with electrolyte derangement	26	59.1
Hypoglycaemia	2	4.5
Substance abuse	3	6.8
Pharmacologic poisoning	1	2.3
Hepatic encephalopathy	3	6.8
Uraemic encephalopathy/HUS	4	9.1
Epileptic	**27**	**6.6**
Afebrile status epilepticus	19	70.4
Febrile status epilepticus	8	29.6
Cerebrovascular Accident	**12**	**3.0**
Ischemic infarction	11	91.7
Hemorrhagic	1	8.3
Hypoxic encephalopathy	**15**	**3.7**
Hypertensive encephalopathy	**2**	**0.5**
CNS Tumours	**13**	**3.2**
CNS complications of leukemia	**5**	**1.2**
Unknown causes	**8**	**2.0**

Concerning the cause of coma among the 406 patients: Neuro-infection constituted 280 (69.0%) of cases of coma, followed by metabolic/ toxic causes in 44 (10.8%), and epileptic causes were 27(6.6%), while in 8 (2.0%) patients the cause of coma was unknown.

Figure1: Shows that of the 406 patients admitted for NTC. Three hundred and nineteen (78.6%) were discharged, 71 (17.5%) of them died, 14 (3.4%) of the patients were discharged against medical advice (DAMA), and 2 (0.5%) were referred to other centers.

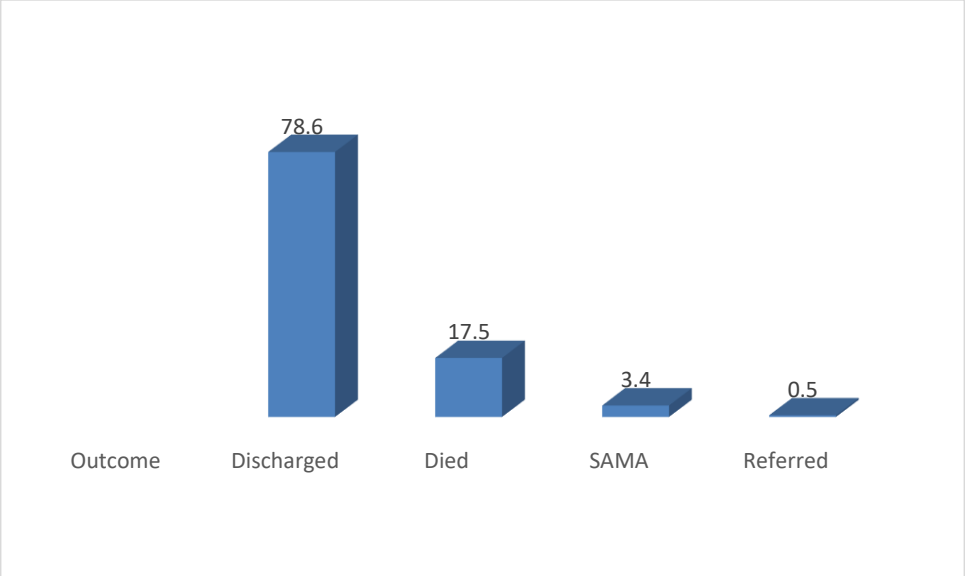

Figure 1: Outcome of children admitted with non-traumatic coma.

Fig 2: Showed the degree of disability on discharge: 256 (80.3%) of the 319 patients were discharged with no disability, 32 (10.0%) had mild disability, 16 (5.0%) of them had moderate disability while 11 (3.4%) had severe disability and 4 (1.3%) remained in permanent vegetative state.

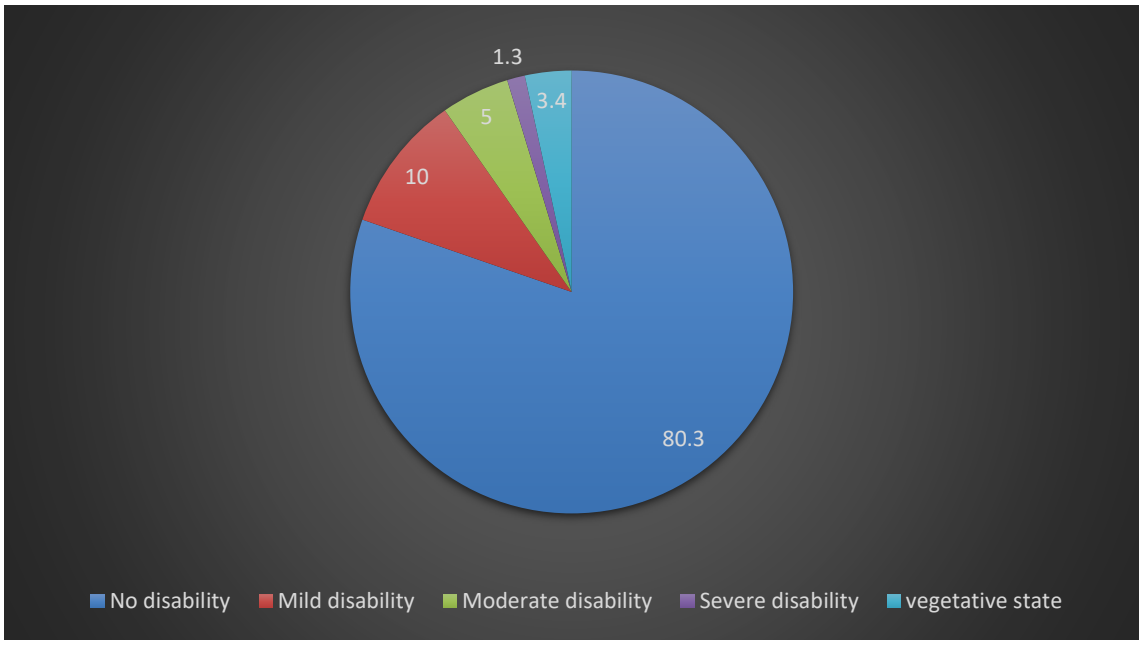

Figure 2: Degree of disability on discharge

Table 3: Shows the outcome of patients: Of the 390 patients, 256 (65.6%) recovered without disability, 63(16.2%) of them had various degrees of disability on discharge, while 71(18.2%) of them died.

Table 3: Shows the proportion of children who died, who recovered with and without disability.

Variables	Outcome N= 390			Total
	RWoD	RWD	Died	
Sex				
Males	104(56.2)	39(21.1)	42 (22.7)	185(100)
Females	152(74.1)	24(11.7)	29 (14.2)	205(100)
Total	**256 (65.6)**	**63(16.2)**	**71(18.2)**	**390(100)**
Age				
< 5 years	131(61.5)	35(16.4)	47(22.1)	213(100)
≥ 5 years	125(70.6)	28(15.8)	24(13.6)	177(100)
Total	**256 (65.6)**	**63(16.2)**	**71(18.2)**	**390(100)**
DOE at admission				
Mild	173(74.2)	34 (14.6)	26(11.2)	233(100)
Moderate	66 (72.5)	15(16.5)	10(11.0)	91(100)
Severe	17(25.8)	14 (22.7)	35(53.0)	66(100)
Total	**256 (65.6)**	**63(16.2)**	**71(18.2)**	**390(100)**
ICU need				
Yes	25(22.5)	45(40.5)	41(36.9)	111(100)
No	231(82.8)	18(6.4)	30(10.8)	279(100)
Total	**256 (65.6)**	**63(16.2)**	**71(18.2)**	**390(100)**

RWoD= Recovered without disability, RWD= Recovered with disability

Table 4: A bivariate logistic regression was carried out to determine the relationship between patient characteristics and outcomes.

Variables	Outcome N= 390		Total	Chi-square	p-value	OR	95% CI
	Recovered	Died					
Sex				4.77	0.03	0.56	0.33-0.96
Males	143(77.3	42 (22.7)	185(100)				
Females	176(85.8)	29 (14.2)	205(100)				
Age				4.69	0.03	0.55	0.32- 0.95
< 5 years	166(77.9)	47(22.1)	213(100)				
≥ 5 years	153(86.4)	24(13.6)	177(100)				
DOE				64.5	0.000	9.03	4.98-16.37
Mild/moderate	288(88.9)	36(11.1)	324 100)				
Severe	31(47.0)	35(53.0)	66 (100)				
ICU need				36.56	0.000	0.21	0.12-0.35
Yes	70 (63.1)	41(36.9)	111(100)				
No	249 (89.3)	30(10.7)	279(100)				
Total	319(81.8)	**71(18.2)**	**390(100)**				

DOE –Degree of encephalopathy

The sex of the patients significantly determined the outcome, with 77.3% of the males having recovered, compared to 85.8% of the females. Also, 22.7% of the males died compared to 14.2% of the females who died. This difference was statistically significant $\chi^2 = 4.77$, $p = 0.03$, OR = 0.56 (95% CI: 0.33–0.96)

Concerning the relationship between the patient's age and outcome: Of the 213 children who were <5 years old, 166(77.9%) recovered, while of the 177 children who were ≥5 years old, 153 (86.4%) recovered. More children who were less than 5 years old died (22.1%) compared to the 13.6% who were ≥5 years old that died. This was statistically significant $\chi^2 = 4.69$, $p = 0.03$, OR = 0.55 (95% CI: 0.32–0.95)

The degree of encephalopathy on admission and outcome: Of the 324 children who presented with mild to moderate encephalopathy at presentation, 288 (88.9%) recovered, while 36 (11.1%) died. Among the 66 patients who presented with severe encephalopathy, 31 (47.0%) recovered and 35 (53.0%) died. $\chi^2 = 64.5$, $p = 0.000$, OR = 9.03 (95% CI: 4.98–16.37)

Also, the need for ICU admission was a significant factor in determining the outcome. Of the 111 Patients who needed ICU care, 70 (63.1%) recovered, while of the 279 patients who did not need ICU care, 249 (89.3%) recovered. Also, more deaths, 36.9%, occurred among those who needed ICU care at presentation compared to those who did not need ICU care (10.7%) at presentation. $\chi^2 = 36.56$, $p = 0.000$OR = 0.21 (95% CI: 0.12–0.35). Patients who needed an ICU admission at presentation had poorer outcomes.

Discussion

In this study, the prevalence of NTC is 7.9%. This finding is higher than the reports from previous studies from Nigeria, Bangui, and Togo, with a prevalence of 5.9%, 4.3%, and 5.4%, respectively [8, 9,19]. Much lower prevalence has also been reported in other developing [20,21] countries, and this disparity is due to their inclusion criteria, as only children with severe encephalopathy were studied. [20,21] It could also be possible that the duration of the present study may have contributed to the higher prevalence obtained.

Studies from developed countries, however, reported a low prevalence rate compared to the findings in this study and from previous studies from developing countries.[22] The plausible reason could be the better health care available in such a clime.

Our study found that NTC was higher among Under-fives compared to other age groups. This finding agrees with another Nigerian study [8] and a study by Ali et al [23] in Saudi Arabia. Fifty-four percent of children who had NTC in the present study were under-five; this is lower than the 62.5% reported by Ibekwe et al [8]in their study among the same age group [8]. This shows that the younger age group is more vulnerable to diseases, including NTC. The preponderance of under-fives in this study and most studies in developing countries [8,23] is perhaps a result of higher susceptibility to CNS infection in this age group, malnutrition, low socioeconomic status, and lack of immunization, although these factors were not studied in this present study. Furthermore, it would undoubtedly be connected to the primary causes of non-traumatic coma in this region, which include malaria and meningitis, which were common findings in this study.

Our study did not show any sex predominance as the ratio of female to male was 1.1:1, this finding is similar to Wong et al. [4], who reported that there was no sex predilection in the incidence of NTC in children. However, this was in contrast with the findings by Mejiozem et al. [9] and Jhansi Rani et al. [24], who reported a male preponderance. On the other hand, studies have also reported a higher prevalence among females. [25,26] These differences could be due to the study population and the methodologies used.

The common clinical features presented by our participants include fever, convulsions, headache, and vomiting. Several previous researchers had also made similar findings, and just like the findings of our study, convulsion and fever were the two prominent clinical presentations found among children with NTC. [3,8,15]

More than half (59.4%) of the patients admitted with NTC in the present study had mild encephalopathy, a finding similar to the report from Duyu et al. [15] but different from Ibekwe et al. [8], who reported that over 79.5% of children admitted for NTC presented with severe encephalopathy. Several earlier reports had stated various degrees of encephalopathy among children at presentations. [15]

Infection of the CNS, metabolic, epileptic causes, and stroke were the predominant aetiologies of NTC in children in our study, a finding similar to Owolabi et al [27]. We observed that infections of the CNS were the most common in our study. This finding was supported by several other studies [3,15, 17, 26], wherein infection of the CNS was found to be the leading cause of non-traumatic coma in children. The significance of infection as a cause of NTC in children is at variance with hospital-based studies among the adult population, where aetiologies like degenerative diseases and cerebrovascular accidents predominate [28].

Cerebral malaria was slightly higher than meningitis as an infectious cause of NTC in the present study, a finding that conforms to Ibekwe et al [8] in South East Nigeria. This finding was inharmonious with a finding by Gabriel-Job & Wobo [29], who had earlier reported that malaria came second to meningitis as a cause of CNS infection. Given that more of the study participants in their aforementioned study were significantly older than the patients in this one, the study population may be the cause of this discrepancy.

In our study, the second most common aetiologies were the metabolic/toxic causes, a finding that was similar to Duyu et al. [15] but is at variance with other studies from developed countries, where toxic and metabolic aetiologies were the most common cause of NTC. [27,28]

The patient outcome for this present study showed that 78.6% of children with NTC were discharged, 17.5% of them died, 3.4% of them signed against medical advice, and 0.5% were referred to other centers. The mortality rate of 17.5% recorded in this study is comparable with findings from an Iranian [30] study that reported a mortality rate of 16.6% but is lower than previous findings from two Nigerian studies by Ibekwe et al [8] and Ogunmekan et al [9] who recorded a mortality of 32% and 36.7% respectively. The plausible reason for this difference could be the result of the level of encephalopathy at presentation. For instance, in the Ibekwe et al study, nearly 80% of the patients had moderate to severe encephalopathy at presentation.

In the present study, the outcome of NTC is significantly associated with the patient's sex, as mortality was higher among males compared to females, a finding that is like another Nigerian study by Owolabi et al [27], though the Owolabi et al [27] study wasamong the adult population. Although there have been varied reports on the relationship between the sex of the patients and the outcome of NTC in children, while some reported poor outcomes among males, others did not find any significant relationship to patients' sex. [8,30,31]

The degree of encephalopathy on admission was also a significant factor that determined the outcome ($p < 0.001$). The proportion of deaths and severe disability was higher among those with severe encephalopathy compared to others. Ahmed et al. [32] and Bansal et al. [31] also stated the same association.

Similarly, the need for ICU admission was a significant factor that determined the outcome. It is frequently an indication of severe disease, and thus often linked to a higher risk of mortality and morbidity.[33] In this cohort, ICU admission was significantly associated with poorer outcomes. This could be a reflection of the severity of their illness, as all those who needed ICU care at presentation had

severe encephalopathy. Furthermore, it could also reflect the unmet need for paediatric ICU care in Port Harcourt, including UPTH, with a resultant low survival rate of critically ill children.

In this study, age significantly determined the outcome. The lower the age, the higher the mortality rate, and the higher the number of children who recovered with disability. This finding agrees with Ahmad [32] and Bansal et al. [31], who reported a poorer outcome among younger children who were less than 5 years old.

In our study, 65.6% of those who were discharged were normal without any form of disability, while 16.2% of them were discharged with different degrees of disability. This finding is compatible with reports from two previous studies that had reported normal outcomes without any disability among 60 - 75% of children with NTC from infectious origin. [34, 35] In contrast, Wong [4], Khodapanahandehet al [30], and Bansal[31] reported a much poorer outcome with a higher proportion of disability. The difference may be because nearly 70% of the patients in our study had mild encephalopathy at presentation and hence had a better chance for full recovery.

Conclusion:

This study shows that NTC among children is high in our setting. Infection remainsthe leading cause in children, with fever and convulsionsbeing the common symptoms they present. Male sex, severe encephalopathy at presentation, young age, and the need for ICU admission were factors that determined the outcome. Mortality related to NTC in children is high, and NTC is a common cause of disability. Identifying the cause, instituting prompt management, and providing access to paediatric ICU care, as well as introducing measures to prevent neuro-infections, will reduce the prevalence, morbidity, and mortality associated with NTC.

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