Research

Pattern and Determinants of Outcomes of Neurological Emergencies admitted into Children Emergency Ward in a Tertiary Hospital in Port Harcourt, Nigeria

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Abstract

Background: Neurological emergencies are life-threatening central nervous system disorders, significantly contributing to childhood morbidity and mortality. The sequelae may be irreversible and may impact negatively on the quality of life of affected children and their families. This study identified the morbidity pattern and determinants of the outcomes of children with neurological emergencies in the Children Emergency Room (CHER) of the Rivers State University Teaching Hospital (RSUTH).

Method: A 4-year retrospective study was carried out in the CHER. Data on demography, diagnosis and outcomes of children with neurological disorders were extracted from the records. Data analysed with SPSS 24 were expressed in percentages and frequency tables.

Results: Of the 3040 children admitted in the CHER, 364(12%) aged 0-15 years had neurological emergencies, commoner among males (59.3%) and children aged less than five years (70.9%). Meningitis (40.2%) and febrile convulsion (28.2%) were the topmost diagnoses made. Raised intracranial pressure (17.4%) and head injuries (25.5%) were significantly more prevalent among children aged five years and above. The mortality rate was 61(16.8%) and more among adolescents (30.6%). All the mortalities took place within the first 48hours of admission especially among those with head injuries (46.5%) and perinatal asphyxia (95%), ($p < 0.05$).

Conclusion: Meningitis and febrile convulsion were the commonest neurologic emergencies seen in this study. Mortality rate was high, especially in the first 48 hours of admission and mainly from perinatal asphyxia and head injuries. Education on the prevention and management of neurologic emergencies should be strengthened.

Keywords: Children Emergency Room, Neurological Emergencies, Outcome, Pattern, tertiary hospital**.**

Introduction

Neurological emergencies in children are life-threatening abnormalities of the central nervous system. They are a common cause of visits and hospitalization in paediatric emergency units, contributing significantly to morbidity and mortality among children and adolescents.[1-3] These children at such visits usually require emergency and urgent attention in a bid to avert irreversible cerebral insult or ameliorate the brain injury as much as possible.[4]

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The prevalence of neurological emergencies is variable with respect to locality, gender and time. In Nigeria the prevalence rates vary between 4.8% in Nnewi,[5] 10.7% in Uyo[6] to 20.1 % in Oghara, Delta State.[7] In another study in West Africa, Ngoue et al[8] reported that neurological emergencies were responsible for 10% of all admissions in a paediatric referral centre in Yaounde, Cameroun. The prevalence was 10.3% in a paediatric intensive care unit in Turkey as reported by Garbuz et al.[9] Furthermore, a multi centre study carried out in 3 paediatric emergency units in Italy had prevalence rates of 3.7% - 8.4% among neonates.[10]

The morbidity pattern of these neurological emergencies is also variable and depends on the disease epidemiology of the region. For example, in Nigeria, febrile seizures followed by meningoencephalitis were the two most common neurological emergencies in Uyo[6] and Oghara.[7] However, in an earlier study in Benin city,[11] febrile seizures followed by cerebral malaria were the commoner emergencies reported. In Cameroun,[8] cerebral malaria followed by meningitis were commoner, in contrast to convulsion and cerebral palsy reported in Turkey.[9]

Neurological emergencies can have undesirable adverse effects on the developing brains of children. While some of the effects may be acute and short term like raised intracranial pressure and cranial nerve palsies and can be reversed with treatment of the underlying disorders, other sequelae such as cerebral palsy, hearing, visual, speech and intellectual impairments among others are long term and usually irreversible. They also impact negatively on the economic, medical and social lives of affected children and their families. In addition, some of these children die from the neurological disorders.[12,13] Different studies reported mortality rates from 1.1 to 9.6%[6,8,9,12]

The study was to ascertain the prevalence, morbidity pattern and outcome of children with neurological emergencies admitted into the unit. It will also provide up-to-date data on neurological emergencies among children in our facility and the whole of Nigeria, since previous studies were mostly carried out over a decade ago. These data may be used in health system planning and management in order to improve service delivery and outcome of admitted children.

Method

The study was conducted at the RSUTH, Port Harcourt, Nigeria. Rivers State is in the South-South geopolitical region of Nigeria. Its boundaries on the east are Abia and Akwa Ibom States, west are Bayelsa and Delta States and on the north are Imo and Anambra States. Port Harcourt, its capital, is considered the commercial centre of the Nigerian oil industry. It is known as the treasure base of the nation. It had a population of 5,198,716 at the last census in 2006 with a projected population of 9,567,892 in 2022 at an annual growth rate of 2.96%.[14]

The study was conducted in the CHER in RSUTH. The CHER is a 15-bed capacity room. Children with emergency conditions are usually admitted there for stabilization (usually for about 48hours) and thereafter transferred to the Children Medical ward, Children's Surgical ward or the Special Care Baby Unit for further management. Some are discharged home directly from the CHER. Some children, however, stay much longer than 48hours until they are stabilized. The CHER has consultants, resident doctors, house officers, nurses and other ancillary staff working in it. Patients presenting in the CHER are clerked, examined and a diagnosis made. Investigations are carried out and treatment administered to the patients. Patient data are also entered into a CHER register/record book.

This was a four-year retrospective study of patients with neurological emergencies admitted into the CHER of the RSUTH from January 1st 2017 to December 31st 2020. Ethical approval was obtained from the ethical committee of the Rivers State Hospital Management Board. This study was therefore undertaken in the Paediatric emergency unit of the Rivers State University Teaching Hospital (RSUTH). Data extracted from the record books were age, sex, date of admission, time of admission, diagnosis, duration of admission and outcome. Outcome was classified as transferred out to other wards, discharged home from CHER, discharged against medical advice, died, absconded or referred out of the facility to another facility. Time of admission was classified as daytime (6am to 6pm) or nighttime (6pm to 6am). The unit runs a 24-hour, round the clock shift and receives patients from the Children's outpatient unit, self-referred patients or patients referred from private or other government health facilities (primary, secondary or tertiary) from within or outside the State.

The data obtained were analyzed using the Statistical Package for Social Sciences (SPSS) IBM version 24

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(Armonk, NY). The results are presented as frequency tables, percentages and charts. The Chi test was used to test for association between dependent and independent variables. The statistical test for significance was set at P value < 0.05 at 95% confidence interval.

Results

A total of 3040 children were admitted into the CHER over 4 years (2017 to 2020), out of which 364 had neurological emergencies, giving a prevalence of 12.0%. They were aged 0-15 years. Majority, 216 (59.3%) were males and 148 (40.7%) females. The male to female ratio was 1.45:1. The mean age of the study population was 3.67±4.02 years. 258 (70.9%) were aged 0-4 years, 56 (15.4%) aged 5-9 years, 48 were aged 10-14 years and 2 (0.5%) greater than 14 years. Most of the children (39.8%) were admitted in 2018 as shown in Figure 1. Of all the children admitted, 212 (58.2%) were admitted at daytime between 6am and 6pm while the rest 152 (41.8%) at night.

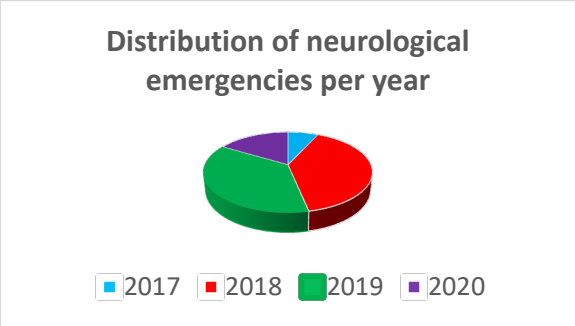

Figure 1: Distribution of children admission per year

Pattern of Neurological disease

Meningitis/meningoencephalitis 146 (40.1%) was the commonest neurological disorder seen in the emergency ward. This was closely followed by febrile seizures 103(28.3%) while 42 (11.5%) of the children had raised intracranial pressure and 41 (11.3%) had head injuries (figure 2). Ten children (2.7%) admitted into the ward with neurological disorders was as a result of road traffic accidents and all of them had head injury, while 59 (16.2%) had anaemia with a blood transfusion rate of 35 (9.6%).

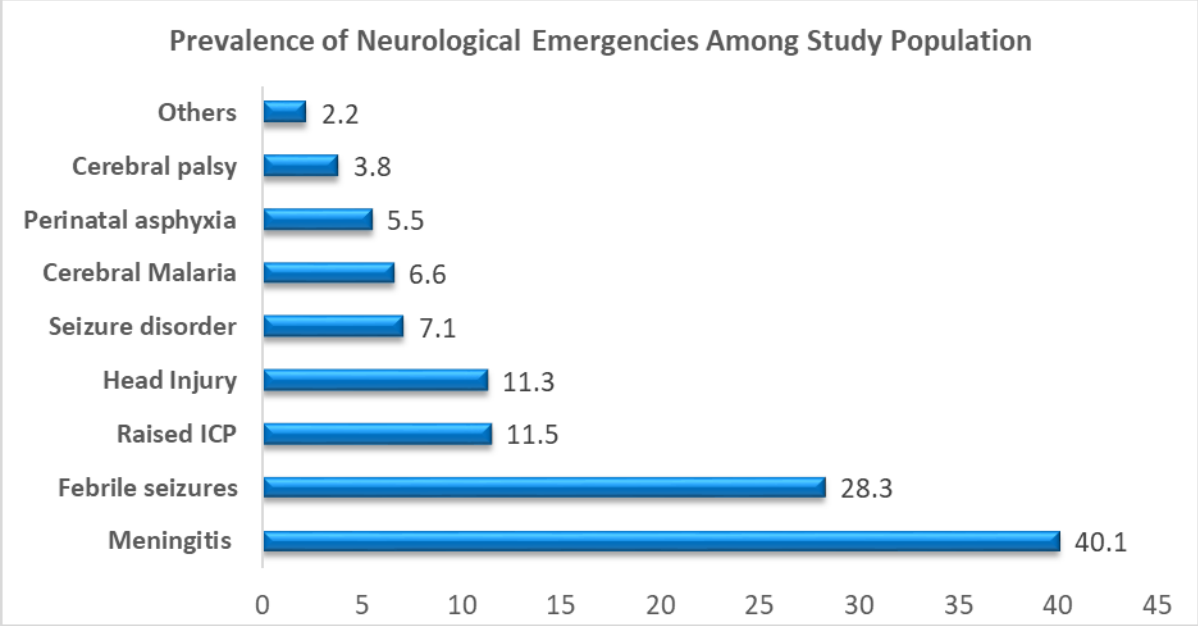

Figure 2: Prevalence of neurological disorders admitted in CHER

Table 1: Prevalence of neurological disorders of the study population according to gender

Neurologic disorder	Female (n=148) N (%)	Male (n=216) N (%)	Total (n=364) N (%)	P Value
Meningitis/meningoencephalitis	67 (45.3)	79 (36.6)	146 (40.1)	0.060

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Neurologic disorder	Female (n=148) N (%)	Male (n=216) N (%)	Total (n=364) N (%)	P Value
Febrile seizures	42 (28.4)	61 (28.2)	103 (28.3)	0.534
Raised Intracranial pressure	14 (9.5)	28 (13.0)	42 (11.5)	0.195
Head injury	14 (9.5)	27 (12.5)	41 (11.3)	0.233
Seizure disorder	9 (6.1)	17 (7.9)	26 (7.1)	0.332
Cerebral malaria	9 (6.1)	15 (6.9)	24 (6.6)	0.461
Perinatal asphyxia	5 (3.4)	15 (6.9)	20 (5.5)	0.107
Cerebral palsy	5 (3.4)	9 (4.2)	14 (3.8)	0.464

Table 1 shows that meningitis was the most prevalent neurological disorder among the children admitted in the CHER. Although meningitis was more prevalent among females, it was not statistically significantly different. Head injury raised intracranial pressure, seizure disorders, cerebral malaria and perinatal asphyxia were more prevalent among males but the differences in prevalence observed between both sexes was not significant.

Although not statistically significant, meningitis/meningoencephalitis was more prevalent among children aged 5 years and above (46.2%). Head injury (25.5%) and raised intracranial pressure (17.9%) were significantly more prevalent among the older children compared to under-fives (p value < 0.05), Table 2.

Table 2: Prevalence of neurological disorders among under-fives and older children

Neurological disorder	< 5years (n=258) N (%)	≥ 5 years (n=106) N (%)	Total (n=364) N (%)	P- Value
Meningitis/meningoencephalitis	97 (37.6)	49 (46.2)	146 (40.1)	0.080
Raised Intracranial pressure	23 (8.9)	19 (17.9)	42 (11.5)	0.014*
Head injury	14 (5.4)	27 (25.5)	41 (11.3)	0.000*
Seizure disorder	15 (5.8)	11 (10.4)	26 (7.1)	0.097
Cerebral malaria	14 (5.4)	10 (9.4)	24 (6.6)	0.123
Cerebral palsy	12 (4.7)	2 (1.9)	14 (3.8)	0.173**

*significant ** Fishers exact test

Among the 42 children with raised intracranial pressure, 32 (21.9) had meningitis while 10 of them did not and it was a significant difference (P=0.000).

Table 3: Prevalence of raised intracranial pressure in different neurological disease of the study population

Neurological disorder	Raised Intracranial Pressure Yes N (%)	No N (%)	Total N (%)	P Value
Meningitis/meningoencephalitis	32 (21.9)	10 (4.6)	42 (11.5)	<0.001
Head injury	6 (14.6)	36 (11.1)	42 (11.5)	0.329
Seizure disorder	0 (0.0)	42 (12.4)	42 (11.5)	0.037
Cerebral malaria	2 (4.8)	40 (11.5)	42 (11.5)	0.460
Cerebral palsy	1 (7.1)	41 (11.7)	42 (11.5)	0.504
Perinatal asphyxia	0 (0.0)	42 (12.2)	42 (11.5)	0.080
Febrile Seizure	1 (2.4)	102 (31.7)	103 (28.3)	<0.001

Outcome of admission into the CHER

The duration of the admission was from 0-17 days. Majority of the children 215 (59.1%) were cared for in CHER within 0-48 hours, 123 (33.8%) 3-7 days and 26 (7.1%) for more than 7 days. The mean of the number of days spent in CHER was 2.66±2.90 days. The sum of the duration of admission in CHER for all children with neurological disease was 969 days or 2.7years.

Of the 364 children with neurological disorders admitted in the CHER, 177 (48.6%) were transferred to the

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children's wards, 69 (19%) discharged home from the CHER and 61 died, giving a mortality rate of 16.8%. The mean duration for admission for children that died was 0.34 ± 0.08 days.

Table 4: Outcome of neurological disorders in CHER

Outcome	Freq	Percent (%)
Absconded	2	0.5
Died	61	16.8
Discharged	69	19.0
+DAMA	37	10.2
Referred	18	4.9
Transferred	177	48.6
Total	**364**	**100**

+DAMA- Discharged against medical advice.

Factors associated with mortality among children with neurological disorders

The mortality rate among adolescents aged 10 years and above (30%) was almost twice of that recorded among under-fives (15.5%) and it was statistically significant (P = 0.018). All the children that died, died within 2 days of admission, Table 4.

There were no mortalities recorded among children with cerebral malaria, febrile seizure and cerebral palsy. The mortality rates were statistically significant among children diagnosed with perinatal asphyxia (95%) and head injury (46.3%), P < 0.05, see table 6.

Table 5: Mortality rates according to demographic characteristics

Parameters	Died		P value
	Yes (n=61) N (%)	No (n=303) N (%)	
Age group (years)			
0-4	40 (15.5)	218 (84.5)	0.018
5-9	6 (10.7)	50 (89.3)	
≥ 10	15 (30.0)	35 (70)	
Gender			
Female	22 (14.5)	126 (85.1)	0.257
Male	39 (18.1)	177 (81.9)	
Time of admission			
Day time	31 (14.6)	181 (85.4)	0.126
Night time	30 (19.7)	122 (80.3)	
Duration of admission (Days)			
0-2	61 (28.4)	154 (71.6)	<0.001
3-7	0 (0.0)	123 (100)	
> 7	0 (0.0)	26 (100)	
Year of admission			
2017	9 (36.0)	16 (64.0)	0.052
2018	20 (13.8)	125 (86.2)	
2019	23 (17.2)	111 (82.8)	
2020	9 (15.0)	51 (85.0)	

Table 6: **Mortality rates according to neurological emergency**

Parameters	Died		P value
	Yes (n=61) N (%)	No (n=303) N (%)	
Head Injury			
Yes	19 (46.3)	22 (53.7)	<0.001
No	42 (13.0)	281 (87.0)	
Perinatal asphyxia			
Yes	19 (95.0)	1 (5.0)	<0.001
No	42 (12.2)	302 (87.8)	
Raised Intracranial pressure			

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Parameters	Died		P value
	Yes (n=61) N (%)	No (n=303) N (%)	
Yes	8 (19.0)	34 (81.0)	0.406
No	53 (16.5)	269 (83.5)	
Meningitis			
Yes	22 (15.1)	124 (84.9)	0.288
No	39 (17.9)	179 (82.1)	
Seizure disorder			
Yes	1 (3.8)	25 (96.2)	0.047
No	60 (17.8)	278 (82.2)	

Discussion

This study on the pattern and outcomes of neurological emergencies admitted into CHER over a period of four years showed a prevalence of 12% with meningitis/meningoencephalitis and febrile seizures being the commonest. More males than females were affected. Majority of the children were discharged from CHER while 61 of them died giving a mortality rate of 16.8%. The mortality rate was significantly higher in adolescents with most deaths occurring within 48 hours of presentation in CHER.

The prevalence of 12.0% documented in this study is comparable to reports of 10.7% in Uyo,[6] 11.5% in Enugu[14] in Nigeria, 10.0% in Cameroun[8] and 10.3% in Turkey[9] but lower than the 15.7% in Benin[11], 20.7% in Oghara[7] and the 29.1% in an earlier study in Enugu[14] all in Nigeria and the 17.0% in a rural centre in Congo.[12] The prevalence in our study was much higher than the 4.8% in Nnewi,[5] the 5% in an urban centre in Congo[12] and 3.4% in France.[17] The similarities in prevalence in Nigeria may be due to similarities in nature of study (retrospective), geographic region and climate. The higher prevalence in the Congo report[12] could be due to the fact that it was a prospective study, and the cases were actively sought for unlike a retrospective study that could actually miss out on the cases. The Congo report[12] was also from a facility located in a rural area unlike ours which is in an urban centre. The lower prevalence in France[17] may be due to it being a more developed nation with a better control of infectious diseases hence neurological emergencies of infectious origin are relatively fewer.

More males presented with neurological emergencies than females in this study, although this was not statistically significant. This is similar to reports from Uyo,[6] Enugu,[14] Congo.[12] Males generally have a higher biologic vulnerability to infections than females. It is also possible that the cultural preference for the male sex would make parents bring their male children to the hospital more than the female children. More studies would be required to conclude on this.

Majority of the patients were aged less than 5 years while those older than 14years were the least affected. This is similar to reports from other centres.[5,8] The reason for this finding could be due to the immaturity of the immune system of younger children with a higher predisposition to infections and poor fight against such infections.

The commonest neurological emergency in this study was meningitis/meningoencephalitis similar to the report from Cameroun.[19] This finding is however, different from the reports from previous studies in Nigeria[1-4] where febrile convulsion was the commonest cause. This may signify a shift from the long-standing febrile convulsion as the commonest cause of neurological emergencies as it was the second commonest cause in this study. Meningitis noted to be commoner in children less than 5years may be due to their sub-optimal immunity which improves as they get older. Head injury as a neurological emergency was commoner among older children. This is similar to a report by Udoh et al.[20] This may be due to the fact that older children are more independent so likely to be involved in road traffic accidents, falls as well as have more stable friends with whom they can play rough injurious games.

The outcome of these children varied - majority of them were transferred to the ward after stabilization in the CHER similar to the report by Ndukwu et al in Nnewi,[5] Iloeje et al.[15]

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In this study a high percentage of the patients were discharged from CHER similar to the other reports.[5,11] The mortality rate of 16.8% reported in this study was similar to the 15.8% reported by Ofoevwe in Benin,[11] 13% by Ndukwu in Nnewi, but much higher than the mortality rate from Uyo (6.1%) in Uyo,[6] 7.7% in Enugu,[15] and 9.6% in Turkey.[9] The report of 21% mortality rate from Congo[12] was however, higher than the report from our study. The high mortality may be due to late presentation in the hospital as they would have already accessed treatment in other facilities, visited prayer houses or trado-medical centres before presentation in our facility. Most mortality in this study occurred within 48hours of admission and this is similar to reports from Nnewi,[5] Uyo[6] and Benin.[11] Late presentation may be a cause as well as unavailability of adequate equipment for resuscitation. Mortality was significantly higher among children aged 10years and above. This finding is different from other studies where infectious causes especially among the children under the age of 5years predominated. The causes of mortality were head injury and perinatal asphyxia ad this was statistically significant. In Benin, cause of mortality were cerebral malaria and meningitis,[3] same in Uyo,[1] Enugu[3] and Congo.[4] There were no mortalities from cerebral malaria in this study unlike the report by Oforwe[11] and Akpan[6] where cerebral malaria contributed significantly to the mortality. It is possible that the giant strides made in the prevention and management of malaria may have played a role.

Implications of the Study: This study has shown us that 1-2 out of every 10 children admitted with neurologic emergencies is likely to die within the first 48 hours of admission. Mortality is worse when there is a head injury and perinatal asphyxia. The health system should therefore be strengthened to prevent these children from dying.

Strengths and Limitations of the Study: This was a retrospective single hospital-based study prone to incomplete documentation and may not represent the exact prevalence of disease entities in the community. It has however provided us with data that shows us that there is room for further research in the field of neurological emergencies among children.

Conclusion

Paediatric neurological emergencies are common and most arising from infectious and preventable causes like meningitis. Most mortalities occur within the first 48 hours of presentation hence need for continuous training and retraining of emergency room doctors as well as provision of resuscitation equipment. Effective prevention of meningitis through immunization may reduce morbidity and mortality.

Ethical consideration: - Ethical approval for this study was obtained from the Rivers State Hospital Management Board

Authors' contribution: Woroma Wonodi - Concept development, Abstract, Discussion, Conclusion.
Tamunoiyowuna Grace Okari - Introduction, Methodology, Results.
Both authors approved of the final version of the manuscript.

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