The Spectrum of Neurological Diseases among Children Admitted to the General Paediatric Wards in Eldoret, Kenya

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Abstract

Anecdotal data suggests that neurological diseases are common among children in sub-Saharan Africa. However, the burden is unknown which is thought to have contributed to limited ability to lobby for better healthcare provision and access to reliable supplies to basic neurology treatment. This study sought to determine the hospital prevalence and spectrum of morbidity and mortality of neurological diseases among children. Period prevalence retrospective study of records of children admitted in Moi Teaching and Referral Hospital during the twelve months of 2012 was conducted. Data was collected using a structured questionnaire. Descriptive statistics were used to calculate various proportions. Out of the 2467 children admitted during this period, 227(9.2%) had neurological diseases. The most common neurological disease was Epilepsy (28.6%) followed by febrile seizures (23.8%). Bacterial meningitis, cerebral palsy, TB meningitis and malaria accounted for 16.7%, 6.2%, 9% and 9% respectively. Treatment was adequate and appropriate in 69.6%, inappropriate and appropriate but inadequate in 23.8% and 6.6%, respectively. The overall mortality rate among children with neurological diseases was 8.4% and 52.6% of this was due to bacterial meningitis. The case specific mortality for cryptococcal meningitis, cerebral malaria, tuberculous meningitis and bacterial meningitis was 50%, 33.3%, 33.3% and 26.3 respectively.Factors that were associated with increased probability of death were neuro-physical deficits at admission, diagnostic uncertainty, diagnosis of bacterial meningitis and referral from level 4/5 health facility. Neurological diseases in children in developing countries cause significant morbidity and mortality. Improved diagnosis and timely treatment before neuro-physical occurs may improve outcome. There is need to find out reasons that contribute to poor outcome among children referred from mid-level healthcare facilities.

Key Words: Spectrum, Neurology, Children, Paediatric Wards, Kenya

INTRODUCTION

Neurological disorders are increasingly prevalent in sub-Saharan Africa as a result of malnutrition, adverse perinatal conditions, malaria, the human immunodeficiency virus, other causes of encephalitis and meningitis, demographic transitions, increased vehicular traffic, and persistent regional conflicts. The enormous difficulty in gathering epidemiologic data have resulted in under-reporting and neglect of this disorders despite the fact that neurological (and psychiatric) disorders make up at least 25 per cent (Burton & Allen, 2003) of the global burden of disease and are responsible for an even greater proportion of persons living with disability.

Studies on prevalence of neurological disorders among children admitted to wards are few but generally the rate is about 10%. In Kenya among children admitted with falciparum malaria, 47.6% have been found to have neurological manifestations, and seizures were the most common neurological manifestation (Idro, Ndiritu & Newton, 2007). In Pakistan, among 6089 children admitted to the paediatric ward, 6.7% had neurological diseases (Zaheer, Rashid, & Chishty, 2009). The leading cause of neurological disease was congenital developmental disorders (20%) followed by neoplastic, febrile seizures, infectious, epileptic and cerebral palsy diseases respectively. The overall mortality rate was 17.6% and neoplastic, degenerative and infectious diseases had high case specific fatality rates.

In Pakistan, Ahmed and Ali (2008) looked at 687 children under five years admitted in a general ward and found that 8.9% had neurological diseases. Infectious diseases are the leading cause of disease (62.5%) followed by epilepsy, febrile seizures and cerebral palsy respectively.

In Africa, Osuntokun (1971) in Nigeria found the prevalence of neurological disorders to be 4.3% and the leading causes are infectious diseases especially tetanus and meningitis. This pattern seems to have

changed as shown by later studies; Kwasa (1992) in Kenya reported prevalence of 7.5% and though infectious diseases were leading, tetanus was not reported. In Nigeria, a prevalence of 6.7% has been reported and the leading diseases are epilepsy, cerebral palsy and infectious diseases respectively (Frank-Briggs & Alior, 2011). Similar findings showing relative increase in seizure disorders have been reported in Tanzania (Winkler, Mosser & Schmutzhard, 2009).

The study therefore aimed at determining the burden of neurological disorders among children admitted in MTRH and describing the spectrum of disorders seen in order to generate data that may be used to plan for the care of these children.

MATERIALS AND METHODS

The study was a retrospective review of medical records of all children admitted to the general paediatric wards of Moi Teaching and Referral Hospital (MTRH) which is a tertiary hospital in western Kenya. Data was collected by use of a structured questionnaire that included information on age, sex, diagnosis, certainty of diagnosis, neurological deficits, investigations, treatment and outcome and disease leading to death. The authors used a modified version of classification of certainty of diagnosis developed by Winkler *et al*. (2009) in Tanzania as follows: Group 1 - diseases without diagnostic uncertainties based on a) medical history, clinical examination and laboratory plus imaging results; Group 2 - diseases that are known, but which remain with minor diagnostic uncertainties where presumptive diagnoses may be reached, but for confirmation of diagnosis, sub categorisation and appropriate treatment, more sophisticated tests would be necessary, and Group 3 - diseases that are unknown, thus representing major diagnostic uncertainties, they can however be described and grouped accordingly.

Descriptive statistics were used to calculate proportions of variables in various categories. Logistic regression was used to determine variables associated with mortality and significant association was considered were p was less than 0.05. The study was approved by Institutional Research and Ethics Committee (IREC) of the School of Medicine, Moi University and Moi Teaching and Referral Hospital.

RESULTS

A total of 2467 children were admitted in the study period out of which 227 had neurological disorders; therefore, neurological diseases directly led to 9.2% of admissions. Majority of the children were male with M: F ratio of 1.6:1. Admissions were greatest among infants and children under the age of five years (70.9%) and majority (56%) were in the age group 1 to 5 years as shown in Table 1. Looking at referral source, it was found that 158(69.6 %) of the patients came by self, 38(16.7%) as referrals from level 2/3 facilities and 31 as referral from level 4/5 facilities as shown in Table 1.

The leading diagnosis was epilepsy 65(28.6%) followed by febrile seizures 54(23.8%). Others were bacterial meningitis at 38(16.7%), cerebral palsy at 14(6.2%), TB meningitis and cerebral malaria at 9(4%) each, and HIV encephalopathy at 2(0.9%) as shown in the Table 2. The diagnoses were certain in 179(78.9%) of the cases while minor uncertainty and major uncertainty were found in 34(15%) and 14(6.2%) of the cases respectively (Table 1). In a majority of the cases, 144(63.4%), aetiology of disease was unknown while in the 83 (36.6%) cases where aetiology was known, 44 (53%) was due to acute infections. At admission 148 (65.2%) of the patients had no neurological physical deficits while 79(34.8%) had deficits.

Treatment offered in the wards was judged to have been appropriate and adequate in 158 (69.6%), appropriate but inadequate in 15 (6.6%) and inappropriate in 54 (23.8%) as shown in Table 1. Among those children tested for HIV, 6.6% were positive.

Table 1. Socio-demographic and clinical characteristics of children admitted to MTRH with neurological diseases

Characteristic	Frequency
Age Group	
Up to 1 year	38 (16.7%)
>1 year to 5 years	123 (54.2%)
> 5 years	66 (29.1%)
Gender	
Male	14 1 (62.1%)
Female	86 (37.9%)
Referral	
Self	158 (69.6%)
Level 2/3 (Dispensaries and Health centres)	38 (16.7%)
Level 4/5 (District and Provincial hospitals)	31 (13.7%)
Diagnostic certainty	
No uncertainty	179 (78.9%)
Minor uncertainty	34 (15%)
Major uncertainty	14 (6.2)
Neuro-physical deficit on admission	
None	148 (65.2%)
Present	79 (34.8%)
Neurophysical deficit at discharge	
None	166 (73.1%)
Present	61 (26.9%)
Treatment	
Appropriate and adequate	158 (69.6%)
Appropriate and inadequate	15 (6.6)
Inappropriate	54 (23.8%)
Duration in hospital	
Up to 1 day	10 (4.4%)
2 to 7 days	160 (70.5%)
>7 days	57 (25.1%)

Table 2. Frequency of morbidity among children admitted in MTRH with neurological diseases

Disease	Frequency	Percent
Epilepsy	65	28.6
Febrile Seizures	54	23.8
Bacterial meningitis	38	16.7
Cerebral palsy	14	6.2
TB meningitis	9	4
Cerebral malaria	9	4
Encephalitis	5	2.2
CVA	4	1.8
SOL	3	1.3
Head Injury	3	1.3
Acute psychosis	3	1.3
Movement Disorder	2	1.3
Cerebellar ataxia	2	0.9
HIV encephalopathy	2	0.9
Cryptococcal meningitis	2	0.9
Hydrocephalus	2	0.9
Others	9	3.6

Outcome

The patients who were discharged home were 208 while 19 died; therefore, the overall fatality rate among patients with neurological disorders was 8.4%. Bacterial meningitis was the leading cause of death (52.6%) as shown in the Table 3. The case specific fatality rate for cryptococcal meningitis, cerebral

malaria, tuberculous meningitis and bacterial meningitis were 50%, 33.3%, 33.3% and 26.3 respectively. Among those who died, 4(21%) were HIV-positive while the rest were negative.

The male to female ratio of the patients who died was 1.1:1 and there was no difference among the age groups as shown in Table 3. Only one of the children who died was referred from level 2/3 health facility while the rest were equally distributed in self and level 4/5 facility referrals. Out of all the children who died, 68.4% had either minor or major diagnostic uncertainty. Most of the patients who died (73.6%) had neuro-physical deficits on admission. Among the patients who died, 13(68.4%) received appropriate and adequate treatment while 6(31.4%) were given inappropriate treatment as shown in the Table 3.

In Binary logistic regression (Table 4), presence of neuro-physical deficits at admission and either minor or major diagnostic uncertainty were associated with higher probability of death while any diagnosis other than bacterial meningitis was associated with decreased probability of death. Gender, age group less or more than 5 years, appropriateness of treatment, duration of hospital stay up to 1 week or more, and whether patients were referred from another facility or came to MTRH directly had no significant association with death. However, as shown in Table 5, on further analysis, patients referred from level 4/5 health facility and those who stayed in hospital for 1 day had a significantly higher probability of death.

Table 3. Profile of the patients who died in MTRH in relation to neurological diseases

Characteristic	Frequency (%)
Age group (months)	
<12	5(26.3)
>12 – 60	8 (42.1)
>60	6 (31.6)
Gender	
Male	10 (52.6)
Female	9 (47.4)
Referral	
Self	9 (47.4)
Level 2/3 (Dispensaries and Health Centres)	1 (5.3)
Level 4/5 (District and Provincial Hospitals)	9(47.4)
Diagnosis	
Bacterial meningitis	10 (52.6)
TB meningitis	3 (15.8)
Cerebral malaria	3 (15.8)
Leucodystrophy	1 (5.3)
Cryptococcal meningitis	1 (5.3)
HIV encephalopathy	1 (5.3)
Diagnostic certainty	
No uncertainty	6 (31.6)
Minor Uncertainty	9 (47.4)
Major uncertainty	4 (21)
Neurophysical deficit on admission	
Present	14 (73.7)
Absent	5 (26.3)
Duration of stay (days)	
1	5 (26.3)
>1 – 7	8 (42.1)
>7	6 (31.6)
Treatment given	
Appropriate and adequate	13 (68.4)
Appropriate but inadequate	0
Inappropriate	6 (31.4)

Table 4. Factors associated with death of patients in MTRH due to neurological diseases (Binary Logistic Regression)

Variable	OR	Significance	95% CI
Male	.836	.752	.28 - 2.53
Diagnosis uncertain	4.916	.009	1.5 - 16.14
Treatment appropriate and adequate	.881	.839	.26 - 3.01
Age group more than five years	.933	.914	.27 - 3.29
Duration of admission more than seven days	1.093	.089	.34 - 3.56
Patient referred from another facility	1.209	.757	.36 - 4.01
Neuro-physical deficit at admission	7.902	.002	2.6 - 28.9
Any diagnosis except Bacterial meningitis	.131	.002	.37 - .46

Table 5. Factors associated with death of patients in MTRH due to neurological diseases (Multinomial Logistic Regression)

Variable	OR	Significance	95% confidence interval	
			Lower Bound	Upper Bound
Gender				
Male	.818	.763	.221	3.028
Female				
Diagnosis				
Certain	.309	.273	.038	2.519
Minor uncertainty	.352	.352	.322	24.21
Major uncertainty				
Treatment				
Appropriate and adequate	1.87	.429	.314	12.6
Appropriate but inadequate	4.03	.264	.35	2.24
Inappropriate				
Age group				
</= 1 month	2	.465	.314	12.6
>1 month to </=5months	0.448	.325	.091	2.21
> 5months				
Duration of stay in ward				
1 day				
> 1day up to 7 days	14.84	.025	1.4	156
> 7 days	.645	.537	.161	2.5
Source of admission				
Self	4	.261	.357	44.8
Level 4/5 Facility	14.53	.032	1.25	167
Level 2/3 Facility				
Neuro-physical deficits on admission				
Present	7.732	.008	1.718	34.8
Absent				
Diagnosis				
Bacterial meningitis	7.172	.009	1.64	31.4
Any other				

DISCUSSION

From the study, neurological disorders accounted for about 9% of all admissions which shows that they are a significant cause of severe disease. Although there is no report of a local study that has looked at prevalence of neurological diseases in children, the finding of a prevalence of 7.5% among adults by Kwasa (1992) is similar to these findings. In addition, studies from Tanzania (Winkler, Mosser & Schmutzhard, 2009) report similar prevalence of about 10%. In Port Harcourt Nigeria (Frank-Briggs & Alior, 2011) a prevalence of 6.7% has been reported among all children seen in out-patient and in-patient departments in a tertiary hospital. Although the Nigerian study included out-patients, it was the only study in the sub-Saharan Africa to have exclusively looked at children and its findings are similar to those in the current study.

Majority of the patients were male; disparity in gender has been reported as a general finding in admissions to paediatric wards. Zaheer *et al*. (2009) reports male gender of 67.7% similar to findings in studies in Pakistan (Shahab, Munir & Bhatti, 2010), Singapore (Hon & Nelson, 2006) and Ethiopia (Muluneh, Shimelis & Benti, 2007). This disparity may reflect other epidemiological factors for male susceptibility to severe illnesss that requires admission. Most of the children were below five years, especially between one year and five years. Similar findings have been reported in other studies and may be explained by epidemiological and immune factors that predispose this age group to infections. MTRH is a referral hospital; however, most of the patients were found to have come directly to the hospital as self referrals. Direct admission to tertiary facilities is common in developing countries and this may be explained by lack of proper referral guidelines and systems that allow patients to choose centres they deem will offer them the best service. An additional factor may be lack of nearby level 4/5 facility in the location of MTRH.

The diagnosis had a high degree of certainty in majority of patients but in a minority, diagnosis was not certain. It has been reported that lack of sophisticated diagnostic equipment in Africa is a limiting factor in diagnosis of neurological disorders (Frank-Briggs & Alior, 2011; Winkler, Mosser & Schmutzhard, 2009). Lack of advanced imaging, metabolic studies and molecular biology could explain the diagnostic difficulty in MTRH. In a review of child neurology services in Africa (Wilmshurst *et al.,* 2011), it has been found that most countries lack the capacity to diagnose common neurological disorders and rare disorders were hardly diagnosed. However, this paper appreciates that the availability of electroencephalography, computed tomography, microbiology and basic biochemistry has lead to increased diagnostic ability.

Treatment offered to patients was appropriate in 70% of patients while in 30% it was either inappropriate or appropriate but inadequate. The study did not look at causes for the lack of appropriate and adequate treatment. However this is a common problem in developing countries as opposed to developed countries and has been attributed to lack of human expertise and or necessary medication (Wilmshurst *et al.,* 2011; Mathers, Lopez, & Murray, 2006).

The leading neurological disorders reported in the study were epilepsy (28.6%) followed by febrile seizures, bacterial meningitis and cerebral palsy respectively. Epilepsy seems to have overtaken infectious diseases as a leading cause of admission due to neurological diseases. Kwasa (1992) has found that the leading cause of neurological disorder admissions is infectious disease followed by epilepsy. The same pattern has been reported by Osuntokun (1971) in Nigeria. In Tanzania, the prevalence of seizures is at 26.6% followed by infectious diseases at 18.1% (Winkler, Mosser & Schmutzhard, 2009). In Port Harcourt, epilepsy is the leading cause of neurological disorders among all admissions, followed by infectious diseases (Frank-Briggs & Alior, 2011). The change in pattern is not surprising when one considers earlier reports that the frequency of non-communicable neurological disorders is on the increase while that of infectious disease was decreasing (Kwasa, 1992; Ogun, Adelewo, Familoni, Jaiyesimi, & Fakoya, 2000). The increase in frequency of epilepsy could be explained by increase in awareness in the background of poor control due to either lack of drugs or expertise which lead to high numbers of uncontrolled patients. The increase in vaccination could explain the decreasing frequency of infections; it is notable that tetanus, measles, polio and diphtheria were not reported in the study.

Overall mortality attributed to neurological disorders was at 8.4% which is a substantial contributor to all cause mortality in MTRH. This mortality rate is however lower than the 21% and 17% reported in

Tanzania (Winkler, Mosser & Schmutzhard, 2009) and Port Harcourt Nigeria (Frank-Briggs & Alior, 2011) respectively. Infectious diseases caused almost all the deaths and of these, bacterial meningitis accounted for more than half of the total deaths although its case specific mortality was less than that of cryptococcal meningitis, TB meningitis and cerebral malaria. Meningitis case specific fatality in MTRH is lower than the 45% reported in an analysis of outcome of meningitis in Africa (Peltola, 2000); which suggests above average care in this facility. However, the rates are higher than the less than 10% reported in more developed countries (Kornelisse, 1995). Although epilepsy was the leading cause of admission, it did not contribute to mortality.

It was expected that inappropriate or inadequate medication would affect the outcome; however, this variable was found to be insignificant probably because it was evenly distributed among groups. Presence of neuro-physical deficits was a positive predictor of mortality which was similar to findings in Pakistan (Ahmed & Ali, 2008) where patients who had intracranial hypertension, coma, hydrocephalus or shock were more likely to die. In the Pakistan study, children aged below five years was significantly associated with death contrary to our study where age was not a significant predictor. This variance could be explained by the high number of deaths caused by neoplastic diseases and degenerative diseases in Pakistan as opposed to the MTRH study. Diagnostic uncertainty was found to be significantly associated with death which could be explained by probable delay in treatment. Efforts at improving diagnostic capability have the potential of improving outcome.

One interesting finding was that patients referred from level 4/5 were more likely to die compared to those referred from level 2/3 facility or self referrals. It is possible that level 4/5 facilities refer patients late or alternatively that they refer only the very seriously ill patients who are unlikely to respond to treatment. It would be important to study the pattern of patients referred from this facilities so as to intervene appropriately. Patients who stayed in the ward for only one day were more likely to die compared to those who stayed longer which could represent those patients who come in seriously sick and die before investigation and appropriate treatment is commenced. This finding could be an indictment for lack of intensive care facilities and expertise in our hospital which predisposes children with acute life threatening complications to death. Notably a diagnosis of bacterial meningitis was associated with increased risk of death and therefore there is need to research on possible interventions that could improve outcome in patients with meningitis.

CONCLUSION

Neurological diseases in children in developing countries cause significant morbidity and mortality. Improved diagnosis and timely treatment before neuro-physical deficits occur may improve outcome. There is need to find out reasons that contribute to poor outcome among children referred from mid -level healthcare facilities.

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BIO-DATA

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