Original Article

Epidemiology of Neural Tube Defects in North Central Nigeria

Dr. A.F. Uba, [+]Dr E.S. Isamade, Dr. L.B. Chirdan, [*]Dr. S.T. Edino, M. E. Ogbe, Dr. G.O Igun.
Departments of Surgery and [+]Anaesthesia, Jos University Teaching Hospital, Jos and *Bayero University, Kano.

Abstract

Background: Neural tube defects (NTDs) are associated with high childhood morbidity worldwide. We wanted to know the pattern and the possible aetiological factors responsible for this anomaly in northcentral Nigeria.

Patients and Methods*:* The clinical records of all children with NTD admitted at JUTH between 1986 and 2003 were reviewed and the data analyzed for age, gender and antenatal care, incidence, type and location of lesion.

Results: There were 284 patients (144 males and 140 females). The incidence of NTD was 0.5/1000 live births and 1.9% of all admissions. The Hausa / Fulani ethnic group constituted the highest proportion. In 165 (58%) patients, the mothers had received antenatal care; however, the antenatal care generally started late in pregnancy. Spina bifida constituted 97% of the total NTDs, 79.6% of which were meningomyeloceles. The sites mostly affected were the lumbosacral and the thoracolumbar regions in 55.8% and 31.9% of cases, respectively. Hydrocephalus was the most common complication occurring in 194 (68.3%) patients. Among those patients presenting with myelomeningocele, 95 (42%) had ruptured sacs, while in 62 (27.4%) the sacs were ulcerated and locally infected; 15 (6.6%) patients had meningitis while 16 (7.1%) had septicemia.

Conclusion: The most common type of NTD in this study was lumbosacral myelomeningocele, the majority of which were complicated at presentation. Consanguinity marriage and delayed or absence of antenatal care appear to be important aetiological factors.

Key words: Neural tube defects, aetiological factors, Nigeria, meningomyelocele, hydrocephalus.

Running Title: Neural tube defects in Nigeria.

Introduction

Neural tube defects (NTDs) are a major health problem worldwide[1-4]. In northcentral Nigeria, as in other parts of the world, NTDs are an important cause of childhood morbidity and misery to many families[1, 5]. Knowledge of epidemiology and sequelae of NTD should assist in formulating and planning health care policies aimed at improving quality of life and eradicating this disorder from the community.

NTDs comprise spina bifida oculta, spina bifida cystica encephalocele, anencephaly, diastematomyelia, various tethered cordy syndromes, syringomyelia and lipoma of the conus medularis. The contributory factors of NTD include malnutrition, drugs, chemicals and genetic aberration, which may affect the normal development of the central nervous system in utero.

There is a large variation in the incidence of NTDs in different parts of the word and at different periods[2-4,6-7]. In developed countries, NTDs constitute a large but diminishing proportion of all major congenital anomalies[4, 8-10]. In Europe[2, 6-7] and the United State of America[10], there has been a steady decline in the incidence of NTD in recent years because of improvements in the standard of living, maternal nutrition, preconception folic acid intake, antenatal diagnosis and termination of pregnancy[2, 7-8,11-12].The situation is different in Saudi Arabia and South Africa where the incidence of NTD has remained consistently high over the last three decades[4, 10]. The scenario in Nigeria is not clear because of the paucity of literature reporting NTD in the country. The incidence of NTD is unknown in many parts of Nigeria, the exception being the 22.5% incidence in western Nigeria reported by Adeyemo and colleagues[13]. The goal of this study was to determine the incidence, pattern, aetiological factors and complications of NTD among children admitted to a teaching hospital in north central Nigeria.

Correspondence: Dr. A.F Uba, Paediatric Surgery Unit, Dept. of Surgery, Jos University Teaching Hospital, P.M.B. 2076, Jos-Nigeria. E-mail: afranu@yahoo.com

Patients and Methods

This study was carried out at the Jos University Teaching Hospital (JUTH), which is the referral hospital for patients requiring specialized investigation and surgery in the northcentral region of Nigeria. The study was hospital-based because of difficulty in obtaining information on birth records in the region. The clinical records of all children with NTD admitted at JUTH between 1986 and 2003 were reviewed and analyzed for age, gender and antenatal care. The type and site of lesion and associated congenital malformations were also analyzed. The yearly incidence of NTD in infants delivered at JUTH, the incidence of NTD among different ethnic groups and the overall incidence of NTD in the region the over the 18 year period were calculated.

Results

There were 144 males and 140 females. Their mean age at presentation was 3 weeks (range: 4hrs – 28 days). In 165 (58%) patients the mothers had antenatal care but the remainder received no antenatal care. Sixteen (9.7%) and 32 (19.4%) mothers commenced antenatal visit by 6th and 12th week of pregnancy, respectively. The remaining women started antenatal visits after the

Table 1: Total number of neonatal admissions and incidence of NTDs in the year 1986 - 2003

Year	Total No of admission	Incidence of myelomeningocele	Incidence of Meningocele	Incidence of enephalocele	Total %
1986	670	0.7	-	-	0.7
1987	850	1.5	0.2	0.2	1.9
1988	845	2.5	-	-	2.5
1989	895	1.8	0.1	-	1.9
1990	740	1.4	0.4	0.1	1.9
1991	880	1.9	0.1	-	2.0
1992	856	1.9	0.2	-	1.1
1993	840	1.4	-	-	1.4
1994	886	2.5	0.6	0.1	3.2
1995	864	1.7	0.2	-	1.9
1996	830	2.0	0.2	-	2.2
1997	836	2.3	0.1	0.1	2.5
1998	860	1.6	-	-	1.6
1999	889	2.0	0.2	0.2	2.4
2000	872	1.7	0.2	-	1.9
2001	882	0.8	-	-	0.8
2002	620	1.3	-	-	1.3
2003	826	2.1	0.1	0.1	2.3

Table 2: Incidence of NTDs among ethnic groups at JUTH from 1986 - 2003

	Neural Tube Defects			
Ethnic Group	Myelomeningocele (n/1000)	Meningocele (n/1000)	Lipomeningocele (n/1000)	Encephalocele (n/1000)
Hausa/Fulani	120(8)	24(1.6)	2(0.1)	3(0.2)
Berom	30(2)	8(0.5)	-	-
Others	76(5)	12(0.8)	4(0.3)	5(0.3)
Total	226(15)	44(2.9)	6(0.4)	8(0.5)

Table 3: Location of NTDs in the year 1986 - 2003

Lesion	Site						Total
	Ls (n)	Tl (n)	Lm (n)	Tc (n)	Oc (n)	Fr (n)	
Myelomeningocele	126	72	28	-	-	-	226
Meningocele	22	9	6	2	3	2	44
Encephalocele	-	-	-	-	5	3	8
Lipomeningocele	6	-	-	-	-	-	6
Total	154	81	34	2	8	5	284

LS, Lumbosacral; tL, thoracolumbhar, Lm, Lumbar; tc, thoracic; Oc, Occipital; Fr, Frontal;

first trimester. Folic acid was one of the drugs routinely prescribed to the mothers during the antenatal visits. Two hundred and eighty four (1.9%) out of a total of 14,940 neonates admitted to JUTH between 1986 and 2003 had a NTD. The yearly admission rate for NTD ranged from 0.7% - 2.5%, suggesting that the frequency of NTD was similar from year to year (Table 1).

In the present study, spina bifida cystica constituted 97% of the total NTDs in the present study. Of the 284 patients with NTDs, 226 (79.6) had meningomyelocele, 44 (15.5) meningocele, 8(2.8) encepheloceles and 6(2.1) lipomeningocele. The incidence of NTDs among different ethnic groups during the commutative period 1986-2003 is shown in Table 2. The predominant ethnic group affected was the Hausa / Fulani.

The sites of the NTDs are shown in Table 3. Of the 226 cases of meningocele, 126 (55.8) were lumbosacral, 72(31.9) were thoracolumbar, and 28(12.3) were lumbar in location. Among the 44 cases of meningocele, the sites were lumbosacral in 22 (50%), thoracolumbar in 9 (20.5%), lumbar in 6(13.6%), head in 8(18.2%) and thoracic in 2(4.5%) patients. Of the 8 cases of encephelocele, 5(62.5) were located in the occipital region, while 3(37.5) occurred in the frontal region. The frontal encephelocele was located at the root of the nose. All the lipomeningoceles occurred at the lumbosacral region.

Hydrocephalus was present in 194 (68.3%) patients, 61.9% developed after the repair of the defect. Of these 194 patients, 182 (93.8%) had myeloneningocele whereas 12 (6.2) had meningocele. Among those patients presenting with myelomeningocele, 95 (42%) had reputed sacs, while in 62 (27.4%) the sacs were ulcerated and locally infected. Of those with ruptured sacs, 15 (6.6%) had meningitis while 16 (7.1%) had septicemia. Other presentations in those with myelomeningocele included paraplegia in 64(20.3%), faecal and urinary incontinence in 84(37.2%) patients, while 112 (49.6%) patients had associated talipes equino varus deformity. One each of the patients with encephalocele had associated microcephaly and syndactyl.

Discussion

The main finding in this study was that the cumulative incidence of NTD in JUTH over the 18 year period was 1.9%, with a yearly range of 0.7 to 3.2%. Although this finding agrees with reports from other parts of the world[4, 8-10], the absence of anencephaly or spina bifida occulta in this series made us to conclude that this incidence is likely to be an underestimation because the children with these anomalies may not have been referred. The wide ethnic variation exhibited between Hausa/Fulani and the Berom (52.5% vs 13.4%) in this study suggests a polygenetically inherited predisposition in the aetiology of NTD. Unlike the Berom, the Hausa/Fulani people practice consanguineous marriage (personal communication), a situation which encourages propagation of genes-based disorders[4-3, 6,14-16]. Genetic counseling and public education to discourage consanguineous marriage may therefore be a necessary step in reducing the incidence of NTD.

One of the dietary factors involved in the aetiology of NTD is folic acid deficiency[4]. Folic acid plays important role in the closure of the neural tube; hence its deficiency has been closely linked with the aetiology of NTD[2, 7,12,17-18]. Over half of the mothers in the present study had antenatal care and were receiving folic acid supplements, but most of them started the antenatal clinic late in the 2nd and 3rd trimester when the neural tube formation would normally have been completed, and folic acid would have produced its desired effect[4]. The critical period during which the neural tube closes is between 21st and 26th day of gestation[4, 8]. This understanding forms the basis for the current folic acid supplementation policies in the developed countries. In Britain, a woman who plans to become pregnant is placed on folate supplementation of 4mg daily from one month before conception to the 12th week of pregnancy[2, 7,18]. In the United State of America, the recommendation is that all women of childbearing age who are capable of becoming pregnant should ingest 0.4mg of folic acid daily in order to reduce the risk of the foetus developing an NTD[19].

In most of our patients, the lumbosacral region is the most affected site. This is in agreement with report from North America[11] but at variance with the preponderant thoracolumbar region found in other studies[2, 4,20]. Myelomeningocele constituted more than 50% of all NTD in this study. Only about one third of our patients with myelomeningocele were already hydrocephalic at presentation. This is lower than the 85% - 90% incidence reported worldwide[2, 11]. In the report by Asindi and Amer[4], the incidence of associated hydrocephalus was 87%. Another disturbing finding in the present study was that in 42% of our patients with myelomeningocele, the sacs were already ruptured

before presentation with consequent infections, meningitis or septicaemia. Such infections portend high morbidity and mortality[5]. The 20.3% incidence of paraplegia 37.2% of incontinence in the present series is much lower than expected, though the reasons for this is not apparent. A number of associated birth defects were noted in our study, with talipes equinovarus deformity occurring in 112(49.6%) of those with myelomeningocele. Other authors[21-22] had observed the multiplicity of birth defects associated with NTD. However, these associated anomalies are not considered to form part of the syndrome of NTD[4]. No case of anencephaly was recorded in our patients. Previous investgators[4] had attributed the paucity of anencephaly in their series to reluctance on the part of Doctors in the peripheral centres to refer patients with such a condition, with a hopeless prognosis.

The high incidence of NTD in this study underscores the need to promote preventive measures aimed at these lesions. Such measures include mass education on the value of early antenatal care and preconception folic acid intake. Also, considering the wide ethnic variation and the role of parental consanguinity in the incidence of NTD, there is a need to advocate genetic counseling for neural tube defects in the region.

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