

ORIGINAL ARTICLE

Prevalence of neural tube defect and hydrocephalus in Northern Ghana

A. Alhassan¹, A. Adam^{2, 3}, and D. Nangkuu⁴

¹Department of Anatomy, ²Department of Surgery, school of Medicine and Health Sciences, ⁴Department of Biomedical Laboratory Science, School of Allied Health Sciences, University for Development Studies, ³Tamale Teaching Hospital, Tamale, Northern Region, Ghana

Neural tube defects (NTDs) are congenital anomalies of the central nervous system (CNS) which affects approximately one in every thousand pregnancies. The estimates, however, varies from country to country with countries implementing national programme on folic acid fortification recording lower estimates. Neural tube defects are a common cause of morbidity and mortality especially in low-middle income countries such as Ghana. The study was conducted to determine the prevalence of neural tube defect and hydrocephalus in the only tertiary hospital in northern Ghana. This was a 4-year retrospective study from January 2010 to December 2014. Data regarding the age, sex, clinical diagnosis, and treatment outcomes were all retrieved from the registry of medical records using a simple data form designed for this study. During the study period, there were 35 426 deliveries at the facility with 57 cases of neural tube defects, thus giving a prevalence of 1.6 per 1000 births. They were more males than females with a male: female ratio of 2.4:1. All cases were diagnosed at birth. All the cases reported in this study were open neural tube defect (NTD). The most common defect was hydrocephalus occurring in 33 patients representing 57.9%, with spinal bifida occurring in 21 patients representing 38.6%. Encephalocele or cranium bifida occurred in only 5.3% (3 patients). Among the spinal bifida cases, myelomeningocele occurred in 13 patients (59.1%), with meningocele occurring in 8 patients (40.9%). Case fatality was about 15% of diagnosed cases. The prevalence of NTDs in this study is relatively high compared to earlier studies but, is consistent with other findings in the sub-region. Prenatal screening and diagnosis are highly recommended since most women undergo routine ultrasonography as part of antenatal service.

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INTRODUCTION

Neural tube defects (NTDs) are severe congenital malformations secondary to abnormal neural tube closure that occur between the third and fourth weeks of gestation. These malformations result in structural defects occurring anywhere along the neuroaxis from the developing brain to the sacrum and often result in the exposure of neural tissue (Lemire *et al.*, 1972). They may be very severe and are associated with miscarriages, stillbirths, neonatal deaths, and with serious neurological and physical problems in the majority of individuals who survive (Locksmith and Duff, 1998). Neural tube defects

(NTDs) are among the commonest congenital malformations in most populations and are estimated to occur in about 400 000 births per year worldwide (Verity *et al.*, 2003; Greene and Copp, 2014; Zaganjor *et al.*, 2016).

Folate deficiency has a well-established teratogenic effect, leading to an increasing risk of neural tube defects. NTDs is associated with substantial mortality, morbidity, and long-term disability, as well as emotional, psychological, and great emotional impact on affected families (Czeizel, 1993; Verity *et al.*, 2003; Fonseca *et al.*, 2013; Zaganjor *et al.*, 2016). In Africa, it is said to affect approximately 1-3 per 1000 birth annually (Buccimazza *et al.*, 1994; Hotez and Kamath, 2009; Farkas *et al.*, 2013). The incidence and aetiology of NTD are said to vary from population to population.

Correspondence: Dr. Alhassan Abass, Department of Anatomy, SMHS, University for Development Studies

E-mail: abassalhassan82@gmail.com

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In Ghana, previous studies suggest that NTD occurs in 1.15 per 1000 births (Anyebuno *et al.*, 1993; Buccimazza *et al.*, 1994; Hotez and Kamath, 2009). NTDs are multifactorial in origin, having both genetic and environmental components (Greene and Copp, 2014). A strong genetic component is indicated by the recurrence risk for siblings of affected individuals. Studies have shown that folic acid deficiency is highly associated with high incidence of neural tube defects (NTDs) (Saqib *et al.*, 2011) and studies have shown that the prevalence of NTDs have been reduced in countries where there are national programmes for the fortification of folate (Czeizel, 1993; Green, 2002; Candito *et al.*, 2004; Candito *et al.*, 2008; Fonseca *et al.*, 2013). There is geographical variation in the prevalence of NTDs and their subtypes (Samson, 2003; Salih *et al.*, 2014; Seidahmed *et al.*, 2014).

Studies have indicated a higher prevalence of NTDs at birth in the north-west and lower rates in the south-west of the British Isles (Frey and Hauser, 2003). In Canada, higher prevalence rate has NTDs have been reported in the eastern part of the country compare with the western portion (Frey and Hauser, 2003). According to Zaganjor *et al.*, (2016), many WHO member states (120/194) do not have any data on NTD prevalence and where data exist, prevalence estimates vary widely.

These findings highlight the need for greater NTD surveillance efforts, especially in lower to middle-income countries. To the best of our knowledge there have not been any study on NTD in this part of Ghana. The present study was conducted to determine the prevalence of neural tube defects (NTDs) and its subtypes in the Tamale Teaching Hospital, Ghana.

MATERIALS AND METHODS

Study design and setting

This retrospective study was carried out at the neurosurgical and neonatal intensive care units (NICU) of the Tamale Teaching Hospital which is a 600-bed capacity Tertiary referral hospital in the savannah ecological zone of Ghana. The hospital also provides

tertiary service to patients from neighbouring countries like Burkina Faso, Mali and Togo. It is the third Teaching hospital in Ghana after the Korle-Bu Teaching Hospital and Komfo Anokye Teaching Hospital.

Ethical consent

This retrospective study was approved by the Committee on Human Research, Publication and Ethics (CHRPE) of the Tamale Teaching Hospital Tamale/Ghana.

Subjects and Data collection

This was a retrospective study involving babies born with neurological anomalies. The study period was from January 2010 to December 2014. Data regarding the age, sex, clinical diagnosis, type of anomaly and management outcomes were all retrieved from the medical records of patients.

Statistical analysis

Patient's information was made anonymous and de-identified prior to entering the data for analysis. Data is presented as frequencies and proportions.

RESULTS

A total of 35 426 deliveries were recorded at the facility during the study period with 57 cases of neural tube defects, giving a prevalence of 1.6 per 1000 births. They were more males with neural tube defects than females with a male: female ratio of 2.4: 1.

All the cases reported in this study were open NTD. The most common defect was hydrocephalus occurring in 33 patients representing 57.9%, with spinal Bifida occurring in 21 patients representing 36.8%. Encephalocele or cranium Bifida occurred in only 5.3% (3 patients) as shown in Table 1.

Among the spinal Bifida cases, myelomeningocele occurred in 13 patients (59.1%), with meningocele occurring in 8 patients (40.9%) as shown in Figure 1.

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Table 1: Type of Anomaly

Anomaly	Number	Percentage
Hydrocephalus	33	57.9
Spinal Bifida	21	36.8
Encephalocele	3	5.3

Data presented as number and percentage

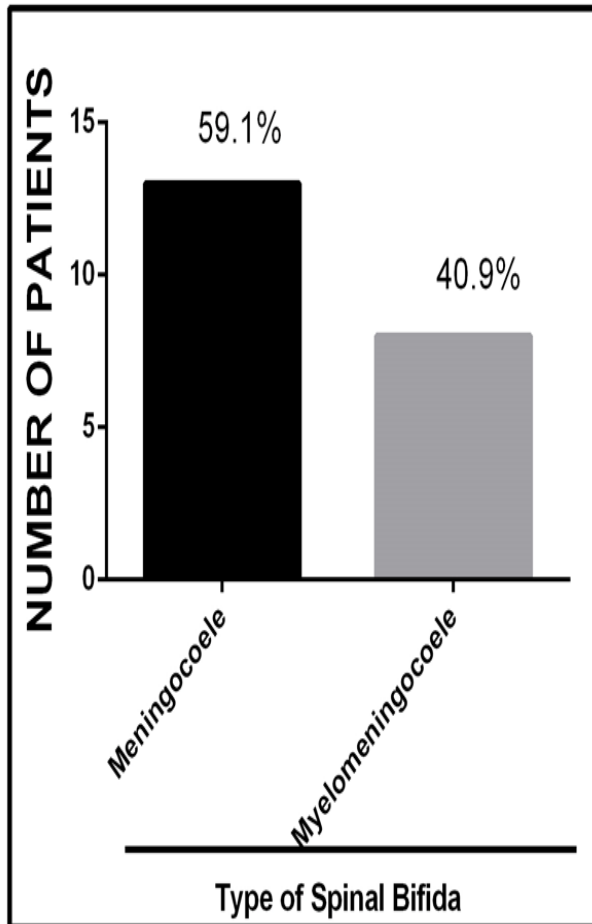


Figure 1: Types of neural tube defect and hydrocephalus

Among the study patients were those with more than one condition. Of the 33 cases of hydrocephalus, 22 cases occurred among patients with neural tube defects. Hydrocephalus was present in 36.4%(8) patients with meningocele, 59.1%(13) patients with myelomeningocele and only in 1 patient with encephalocele as shown in Table 2.

Table 2: Incidence of hydrocephalus in neural tube defect cases

Anomaly	Number	Percentage
Meningocele	8	36.4
Myelomeningocele	13	59.1
Encephalocele	1	4.5

Data presented as number and percentage

All the encephalocele cases occurred among male children. Meningocele and Myelomeningocele were more common in male children than females as shown in Table 3. About 62% of meningocele, 69.2% of myelomeningocele and 57.6% of hydrocephalus occurred in male children.

Table 3: Distribution of anomalies with sex

Anomaly	Total n(%)	Male n(%)	Female n(%)
Meningocele	8(14.0)	5(62.5)	3 (37.5)
Myelomeningocele	13(22.8)	9(69.2)	4 (30.8)
Encephalocele	3(5.3)	3(100.0)	0 (0.0)
Hydrocephalus	33(57.9)	19(57.6)	14 (42.4)

Data presented as number and percentage

Case fatality

A total of 9 (15.8%) patients died during the period with 48 (84.2%) patients surviving. 8 out of the 9 fatalities occurred among patients with hydrocephalus and the remaining fatality occurring in myelomeningocele patients. The majority of the fatalities were male and the age range was from 1 – 14 days.

DISCUSSION

In the present study, the prevalence of the NTD was 1.6 per 1000 births. This was slightly higher than an earlier study in Ghana which suggested that NTD prevalence among their study subjects was 1.15 per 1000 births (*Anyebuno et al., 1993*). The present results were, however, lower than that reported in Nigeria by *Nnadi et al (2016)* who recorded a prevalence of 2.2 per 1000 deliveries. The results were, however, comparable to the worldwide range of 1–5 per 1000 births, which confirms the observation that reported the incidence of NTDs varies from country to country and even with re-

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gions in the same country. The incidence and aetiology of NTD are said to vary from population to population. In Canada, the prevalence of NTDs is said to be high in the eastern part of the country compared to the western portion (Frey and Hauser, 2003). In Africa, it is said to affect approximately 1-3 per 1000 birth annually (Farkas *et al.*, 2013). NTDs is associated with substantial mortality, morbidity, and long-term disability, as well as emotional, psychological, and great emotional impact on affected families. NTDs are multifactorial in origin, having both genetic and environmental components (Greene and Copp, 2014). A strong genetic component is indicated by the recurrence risk for siblings of affected individuals. Studies have shown that folic acid deficiency is now associated with high incidence of neural tube defects (NTDs) (Saqib *et al.*, 2011) and periconceptional intake of folic acid has demonstrated to be effective in reducing the frequency of neural tube defects (Bidondo *et al.*, 2015; Sargiotto *et al.*, 2015).

The relatively high number recorded in the present study may be attributed to the late reporting of pregnant women to health facilities for antenatal care since folic acid supplementation four weeks after fertilisation may not be useful since the neural tube would have been closed. Preconception and antenatal care services are still a major problem in this part of the country because of most of the communities are very rural and deprived. Most women do not have access to antenatal services because of poverty. Hydrocephalus was the most common defect in the current study. Encephalocele or cranium Bifida was the least defect among our study subjects. Among the spinal Bifida cases, myelomeningocele was the most predominant followed by meningocele. The major congenital anomaly may coexist with NTDs. In the present study, about 30% of patients with Myelomeningocele also had hydrocephalus and this was similar to the findings of other researchers (Nnandi and Singh, 2016). Studies have shown that the incidence of hydrocephalus was highest when the meningocele involved the lumbar or thoracolumbar region than in purely sacral or thoracic lesions (Berry and Patterson, 1991). In addition, the ratios of spina bifida to anencephaly births also seem

to vary between different populations with most studies reporting a higher incidence of spina bifida than anencephaly (Smithells *et al.*, 1980; Williamson *et al.*, 1984; Buccimazza *et al.*, 1994) as seen in the present study.

CONCLUSION

The prevalence of NTD among the subjects was a little higher compared to earlier findings from the southern part of the country even though it was still within the worldwide range. All cases in this study were open NTD with spinal Bifida being the most common form. Myelomeningocele was the commonest form of spinal Bifida. Hydrocephalus was the most common associated congenital abnormality and was closely associated with myelomeningocele. Early antenatal reporting, good maternal nutrition and preconception intake of folic acid may help to reduce the incidence. The use of ultrasonography as a screening tool is also recommended to help to improve early detection.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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