RESEARCH ARTICLE

NEURAL TUBE DEFECTS PREVALENCE IN A HOSPITAL-BASED STUDY IN URMIA

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Abstract

Objective

Neural tube defects including anencephaly, encephalocele, and spina bifida are major congenital malformations with multifactorial etiology, and with a great variation in their prevalence in different populations. The study on the prevalence of these malformations may be helpful in planning strategies for their prevention. The aim of this epidemiologic descriptive study was to determine the prevalence of neural tube defects and to describe their birth characteristics in Motahhari hospital, Urmia, West Azerbaijan.

Materials and Methods

A cross-section observational study was carried on the hospital-based charts of consecutive 13997 live-births and 124 stillbirths during the period January 2001 through June 2005. The defects categorized based on the domains of anencephaly, spina bifida, and encephalocele according to standard definitions.

Results

During this period, 117 cases were detected with neural tube defects, giving an overall prevalence of 8.29/1000. Of 117 cases, 81 (69.23%) cases were seen among stillbirths and 36 (30.77%) cases among live-births, that is, the prevalence of neural tube defects for stillbirths and live-births were 653.2/1000 and 2.57/1000 respectively. The yearly prevalence varies between 6.99/1000 and 9.82/1000 over the 4.5-year period. The major lesion was anencephaly with prevalence of 5.52/1000 (66.67% of all neural tube defects). Approximately, two-thirds (66.09%) of cases were found in females. Weights of 73.36% of anencephalic cases were less than 1000 grams.

Conclusion

In this study, the prevalence of neural tube defects is among the highest reported rates. There was a significance difference in the prevalence of anencephaly, as the most prevalent NTD, between live-births and stillbirths. These findings may necessitate an intensive approach to periconceptional folic acid supplementation as a possible strategy to reduce the prevalence of these defects.

Keywords: Prevalence, Neural Tube Defects, Anencephaly, Spina Bifida, Encephalocele

Introduction

Neural tube defects (NTDs) are major congenital defects with multifactorial etiology and the genes that are involved in the metabolism of folate and homocysteine are reported to play a role in the development of NTDs (1,2). Anencephaly, spina bifida,

and encephalocele are the most common diagnoses used to describe these birth defects. They arise when the neural tube fails properly to develop into the brain and spinal cord during the first month of pregnancy. There is a great variation in the prevalence of NTDs in different populations (3-7). In a multi-centric study in 20 regions of Europe, the total prevalence rates have been between 1.15/1000 and 3.8/1000 during 1980-1986 (8). Prevalence of 0.78/1000 births has been reported in the Asir region of Saudi Arabia (6). The total NTDs prevalence in Ontario, Canada between the years 1986 and 1999 has been varied from 0.86 per 1000 to 1.62 per 1000 live-births stillbirths, and therapeutic abortions (9). Incidence of NTDs in the least-developed area of India has been shown to be 6.57-8.21 per 1000 live-births (7). According to a hospital-based study, the prevalence of NTDs was 5.49/1000 among Palestinians (10).

The aim of the current study was to find the prevalence of NTDs and to describe their birth characteristics in a referral hospital of Urmia. Since NTDs often result in fetal death, early-life death, and developmental disabilities among surviving infants and children, prevention could be an important strategy to relief NTDs burden. Determination of NTDs prevalence in a population may help adopting prevention strategies such as well-documented periconceptional folic acid supplementation which has been reported to have prevention effects on NTDs (11-13).

Materials and Methods

We designed a cross-section observational study to survey medical records of births and stillbirths for a 4.5-year period, from January 2001 to June 2005. It carried out at Motahhari hospital which is a referral obstetrics hospital in the west Azerbaijan province with 2.9 million populations. Data were collected from documented hospital-based records of 13997 live-births, and 124 stillbirths.

In this study, the domains of anencephaly, spina bifida, and encephalocele were considered according to standard definitions. This domain for anencephaly included craniorachischisis, iniencephaly, and other neural tube defects (encephalocele and spina bifida) when associated with anencephaly. Accordingly, the domain of spina bifida included meningocele, meningomyelocele, and rachischisis. Spina bifida was not counted as a separate defect when present with anencephaly. The definition also excluded spina bifida occulta and sacrococcygeal teratoma without dysraphism. Encephalocele was not counted as a separate defect when present with spina bifida.

We calculated the total number and prevalence of NTDs by combining the numbers of NTDs occurring in live births, and stillbirths. We examined overall secular trends using poisson regression analysis for the number of NTDs diagnosed per year (2001-2005), considering the year as a continuous independent predictor variable. The Chi square test for homogeneity in proportions was used to test whether differences in total prevalence rates were significant between sexes or weight groups of cases.

Results

A total of 117 infants and fetuses with neural tube defects were detected among all live births, and stillbirths, that is, 14121 cases (table 1). This gives a prevalence of 8.29/1000.

The most common defect was anencephaly with78 cases (66.67%) followed by spina bifida with 35 cases (29.91%) and encephalocele with 4 cases (3.42%). The yearly prevalence varies between 6.99/1000 and 9.82/1000 over the 4.5-year period. The yearly prevalence difference was not significant (p=0.07).

Considering the sex of cases, 76 cases were female, 39 cases were male, and the sex of 2 cases was undetermined. Excluding the cases with un-known sex from calculation, totally 66.09% of cases were female. The sex difference in NTDs prevalence was significant (p=0.003). Totally 81 out of 117 (69.23%) cases were delivered stillborn, and regarding the type of NTDs this figure for anencephaly, spina bifida, and encephalocele was 93.59%, 17.14%, and 50% respectively.

To find any association between the prevalence of NTDs and the fetus and neonate weight, their weights have been grouped into three groups (table 3). With increasing fetal and neonatal weights, the NTDs prevalence decreases (p=0.00). Table 4 shows the relation between maternal age and the prevalence of neural tube defects.

Discussion

The prevalence of all types of NTDs varies greatly in

different parts of the world, ranging from 0.78/100 to 8.21/1000 (6-10). According to our study, the overall prevalence of NTDs is 8.29 per 1000, which in comparison with the reported rates, is among the highest. The incidence of NTDs reported in India (7) i.e., 6.57-8.21/1000 live-birth is higher than that in our study, that is 2.57/1000 live-birth.

Descending order of NTDs rates was for anencephaly (66.67%), spina bifida (29.91%), and encephalocele (3.42%). This order compatible with findings of a population-based study in California with rates of 49%, 42%, and 8% for anencephaly, spina bifida, and encephalocele respectively (14).

Females are more likely than males to have anencephaly and spina bifida. In a case-control study, about 70 percent of the children with anencephaly and 60 percent of the children with spina bifida were female (15). Our finding is compatible with this finding, that is 69.74% of cases with anencephaly and 60% of cases with spina bifida were females.

In this study, there is a higher rate of neural tube defects among children delivered with low birth weights. Among all infants born with neural tube defects 54.71% of cases had weight under 1000 grams, and 75.23% were low birth weight (less than 2500g) (table 3). This suggests that lethal neural tube defects are a likely cause of early fetal loss.

Approximately 74.36% of anencephalic cases weighed less than 1000g (table 3). 69.23% of NTDs had been seen in stillbirths, this figure was 83% in a study in England, and Wales (16). Only 6.41% had birth weights of 2,500g or more. Among infants with spina bifida, 14.29% were less than 1000g, and 65.71% weighed 2500 g or more.

There is also an association between maternal age and the prevalence of neural tube defects so that the prevalence of NTD-affected pregnancies decreased with increasing maternal age (17,18).

Although we found that 57.27% of NTDs occur in groups with maternal age 20-29, due to lack of information about the maternal age of 14004 unaffected cases, we can not interpret these findings. Another limitation of study is that we did not find registered information about the location of spina bifida lesions in the charts. And also, due to carrying out the study in a referral hospital, data can't be extended to the overall prevalence of the NTDs in the region.

Table 1: Number of NTDs regarding the year of occurrence from 2001-2005; in the year 2005, cases in the first half of the year included.

Year	Anencephaly	Spina Bifida	Encephalocele	Total number of NTDS
2001	22	7	0	29
2002	22	8	3	33
2003	15	6	0	21
2004	12	9	1	22
2005	7	5	0	12
total	78	35	4	117

Table 2: Yearly prevalence of NTDs from 2001 to 2005; in the year 2005, cases in the first half of the year included.

Year	total number of NTDs	total number of births	yearly prevalence per 1000 birth
2001	29	3268	8.87
2002	33	3360	9.82
2003	21	3005	6.99
2004	22	2944	7.47
2005	12	1544	7.77

Table 3: Categorizing the weights of cases into three groups. Rates of all types of NTDs have been shown in the weight groups.

Weight (g)	Anencephaly (78 cases)		Spina Bifida (35 cases)		Encephalocele (4 cases)		Total (117 cases)	
	No.	%	No.	%	No.	%	No.	%
<1000	58	74.36	5	14.28	1	25	64	54.71
1000-2500	15	19.24	7	20	2	50	24	20.52
>2500	5	6.4	23	65.71	1	25	29	24.78

Table 4: Maternal age with 5-year interval grouping. Rates of NTDs have been calculated in all age groups.

Maternal Age (year)	Anencephaly (78 cases)		Spina Bifida (35 cases)		Encephalocele (4 cases)		Total (117 cases)	
	No.	%	No.	%	No.	%	No.	%
<20	11	14.10	3	8.57	1	25	15	12.82
20-24	25	32.05	8	22.86	1	25	34	29.06
25-29	21	26.92	10	28.57	2	50	33	28.21
30-34	9	11.54	6	17.14	0	0	15	12.82
≥35	12	15.38	8	22.86	0	0	20	17.09

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