A STUDY OF NEURAL TUBE DEFECTS

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ABSTRACT

Congenital anomalies are of greater interest to Anatomists, Obstetricians, Paediatricians, & Radiologists. Risk assessment is a part of prenatal care and should begin prior to conception and continue during antenatal period. Our goal should be to prevent the birth of babies with congenital anomalies, such as Neural Tube Defects [NTDs] by supplementing Folic acid & Vitamin B12 during periconceptional period, and early diagnosis by the available screening protocols such as estimation of Alpha Feto Protein [AFP] in amniotic fluid & maternal serum and diagnostic USG, so that clinician can counsel the couple regarding the outcome.

The present study was under taken to know the incidence of congenital anomalies, in Cheluvamba Hospital attached to Mysore Medical College & Research Institute Mysore. Among 3000 births during May September 1999, there were 61 babies with congenital anomalies, among these, 32 babies had neural tube defects. Results were analysed and compared with other studies reported in the literature. Overall incidence of congenital anomalies was 2.03 %, incidence of CNS anomalies was 49.19% and incidence of Neural Tube Defects was 1.06 %.

Key words - Neural Tube Defects [NTDs] Anencephaly, Meningomyelocele, Hydrocephaly, Congenital Diaphragmatic Hernia [CDH], Omphalocele, Ultrasonography [USG]

INTRODUCTION

Incidence of Neural Tube Defects is 2-3 /1000 births. Positive family history is an important risk factor and recurrence risk is 5 % with previous affected child. Incidence of NTDs in India varies from 0.6 13/1000 births & varies in different population. Highest rates of NTDs occur among certain ethnic groups, such as Welsh, Irish, Sikhs. Incidence in U.K., U.S.A. Denmark, & Oman reported as 1.5 / 1000 births.

Failure of fusion of cephalic part of neural tube is known as Exencephaly. Here vault of the skull is not formed and thus the exposed, malformed brain degenerates and is called Anencephaly [brainstem is intact]. In Craniorachischisis closure defect of the flattened neural tube extends along the spinal cord.

Spina bifida is a general term for NTDs affecting spinal region. There are 2 types 1] Spina bifida occulta, in which the defect is due to lack of fusion of vertebral arches, usually in lumbosacral region [L5 S1] & is marked by a patch of hair overlying the region and affects about 10 % of otherwise normal people.

2] Spina bifida cystica is a severe type of defect in which neural tissue and / or meninges protrude through the defect in the vertebral arches and skin to form cyst like sac. Meningocele is a cyst filled with meninges & fluid, where as in Meningomyelocele neural tissue is included in the sac.

In every case of spina bifida cystica there will be abnormal accumulation of cerebrospinal fluid in the ventricles of brain resulting in hydrocephalus. As the vertebral column lengthens, tethering pulls the cerebellum into foramen magnum, cutting off the flow of CSF resulting in hydrocephalus.

The pathogenesis of NTDs is still obscure and controversial. Various factors are attributed as causative agents, such as 1] Hyperthermia 2] Medication of Valproic acid 3] Hypervitaminosis A 4] Deficiency of folic acid & vitamin B12 during periconceptional period 5] Genetic factors.[Sadler T.W. 2009][1]

Reddi Rani, Manjula [2003][2] in their clinical and USG study of evaluation of 100 cases of polyhydramnios observed 40 babies with congenital anomalies, and 21 cases had CNS anomalies [52.5%]. NTDs were 14 [14%]. Balakumar K. [2007][3] studied 30,030 singleton 9 41 weeks gestation, USG done and the analysis reported as 2.59% had major foetal anomalies, 336 cases [39.20 %] had CNS anomalies, NTDs were 250 [0.83%].

Dhapate S.S. et al [2007][4] reported a USG study of 8640 pregnant women attending ANC observed NTDs in 35 cases [0.40%]. Sania Tanveer et al [2008][5] reported study of 3310 deliveries and 46 cases with NTDs giving incidence of 1.39 %. Ghanashyam Das et

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al [2003]6 reported a rare occurence of a case of Dizygotic twin with meningomyelocele in both the babies. Jayesh Sheth et al [2003][7] and Neelam Banergee et al [2002][8] reported a case of recurrence of NTD.

MATERIALS AND METHODS

Study was done to know the incidence of congenital anomalies at Cheluvamba Hospital attached to M.M.C. & R.I. Mysore, during May 1999 to Sept. 1999. There were a total 3000 births includes live births, still births, & aborted foetuses. The total number of babies with birth defects were 61. Among these 19 were live babies and 42 were still born. Details of the anomalous babies were collected from the mother and consent was taken for autopsy of dead babies [26 cases]. These babies were injected with Formalin for fixation, and later autopsy was done. Neural tube defects were observed in 32 cases.

OBSERVATIONS & RESULTS

Total number of births including live births, still births, aborted foetuses 3000

Anomalous babies [live babies 19, still born + aborted foetuses= 42] 61

Babies with neural tube defects 32 Incidence of neural tube defects 10.66 / 1000 births Following classification was made based on different types of NTDs

1. Anencephaly was seen in 15 cases [46.87 %]

USG was done and diagnosed in 10 cases, and termination was done.

Remaining 5 cases never had USG and delivered spontaneously.

Anencephaly alone was seen in 10 cases [1 case with Rachischisis photo 1] 2 cases were associated with congenital diaphragmatic hernia [CDH] [photo2] Omphalocele was seen in 2 cases [photo 3]

1 case was anencephaly with cleft lip & cleft palate.

2. Spinal defects with / without associated defects in 17 cases [53.12%].

USG was done in 11 cases defect was diagnosed in 8 and not diagnosed in 3 cases. Among remaining 6 cases USG was not done, and were diagnosed after birth.

A] Spina bifida with meningocele was observed in 4 cases 3 babies were alive with lumbosacral defect [photo 4 & Radiograph 5] and 1 baby died which had cervical defect.

B] 4 Babies were alive with Spina bifida and meningomyelocele.

C] Among 8 babies with hydrocephalus only 1 was alive and 7 were stillborn. D] Multiple system involvement was seen in 1 case. [hydrocephalus with meningomyelocele & omphalocele, renal agenesis].

Table I: Showing relation of maternal age with NTDs

Table I showing more number of cases with NTDs [16], noted among younger age group [<20 years]. Babies with anencephaly are less [3] among age group of 21-40 years, but spinal cord anomalies are more [13] and

Maternal age yrs.	Anencephaly	Hydrocephalus with meningomyelocele	Meningocele	Multiple defects
13 – 20	7	4	3	2
21 – 40	3	4	5	4
>40	0	0	0	0
Total -32	10	8	8	6

Table I: showing relation of maternal age with NTDs.

Gravida	Anencephaly	Hydrocephaly with meningomyelocele
1	7	8
2	6	7
>2	2	2
Total- 32	15	17

Table II: Maternal parity with NTDs

Gestational age	Anencephaly	Hydrocephaly with meningomyelocele
20 - 28 wks.	8	2
29 - 40 wks.	7	15
Total -32	15	17

Table III: Showing Gestational age among NTDs

Degree of consanguinity	Anencephaly	Hydrocephaly with meningomyelocele
0	10	12
1	0	0
2	4	3
3	1	2

Table IV: Showing consanguinity with NTDs

Sex	Anencephaly	Hydrocephaly with meningomyelocele
Female	12	8
Male	3	9

Table V: Shows frequency of sex of the baby in NTDs.

no cases seen among the age group of >40 years.

Table II: Maternal parity with NTDs.

The above table shows more number of NTDs observed in 1st & 2nd gravida.

Table III: Shows Gestational age among NTDs.

All cases are diagnosed after 20 weeks, as antenatal USG done during 2 nd trimester in 10 cases and during last trimester in 22 cases.

Table IV: Showing consanguinity with NTDs.

Consanguinity had very little role in causing NTDs in the present study.

Table V: Shows frequency of sex of the baby in NTDs.

There is definite female predominance in anencephaly and male predominance in hydrocephaly.

DISCUSSION

In the present study incidence of congenital malformations is 2.03 % that is comparable with standard text books. Incidence of NTDs in the present study is 10.66 / 1000 births. Reddi Rani, Manjula [2003][3]

Study	No. of cases with NTD	Total no. of cases	Incidence/1000 births
Present study	32	3000	10.66
Sania Tanveer	46	3310	13.90
Reddi Rani	14	100	140
Dhapate S.S.	35	8640	4.05
Balakumar K.	250	30030	8.32

Table VI: Showing comparison of incidence of NTDs with other studies.

Type of NTD	Age 13-20 yrs.		21 -40 yrs.		>40 yrs.		Total	
	Present study	Sania study	Present study	Sania study	Present study	Sania study	Present study	Sania study
Hydrocephalus	4	8	4	8	0	5	8	21
Meningomyelocele	3	3	5	2	0	3	8	8
Anencephaly	7	1	3	4	0	1	10	6
NTD with multiple system	2	1	4	8	0	2	6	11
Total	16	13	16	22	0	11	32	46

Table VII: Showing comparison of different types of NTDs in the present study and study reported by Sania Tanveer among different age groups.

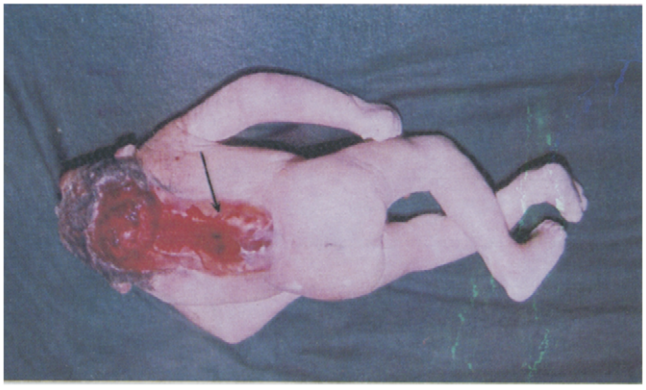

PHOTO NO 1 ANENCEPHALY WITH RACHISCHISIS

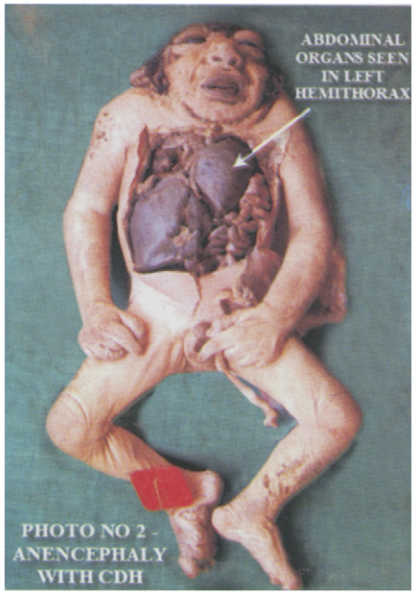

PHOTO NO 2 ANENCEPHALY ASSOCIATED WITH CDH

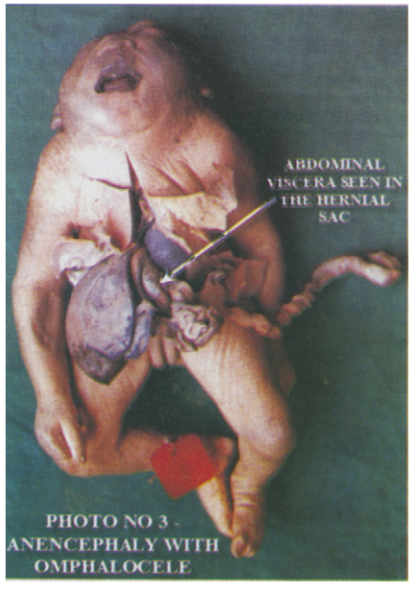

PHOTO NO 3 ANENCEPHALY ASSOCIATED WITH OMPHALOCELE

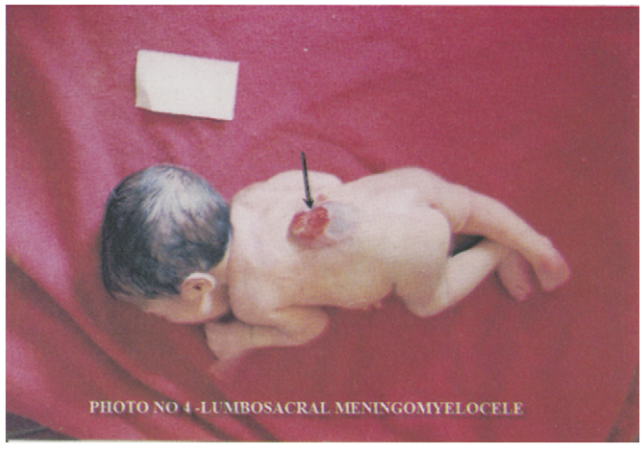

PHOTO NO 4 LIVE BABY WITH LUMBOSACRAL MENINGOMYELOCELE

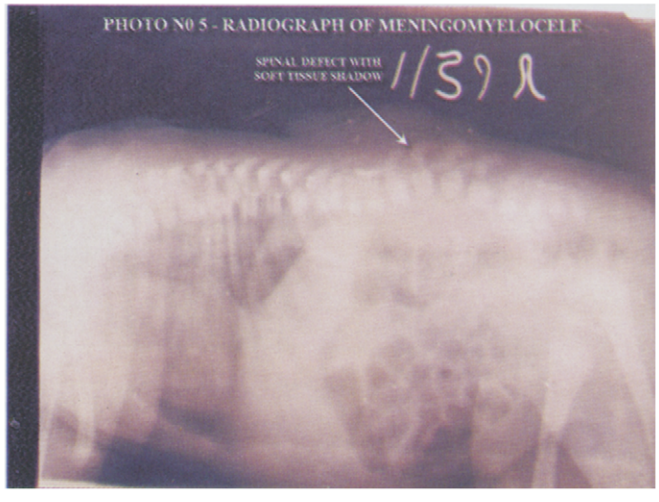

PHOTO NO 5 RADIOGRAPH OF THE SAME BABY WITH MENINGOMYELOCELE

Gestational age in wks.	Present study	Dhapate S.S. study
12 – 20	1	4
21 – 28	8	18
>29	23	13
Total	32	35

Table VIII: Comparison of gestational age with NTDs in present study & Dhapate S.S. study

Neural tube defect	Present study	Sania Tanveer	ReddiRani	Dhapate S.S.	Balakumar K.
Anencephaly	10	6	9	17	108
Hydrocephalus with spina bifida	8	21	2	14	102
Meningomyelocele	8	8	0	3	17
NTD with multiple defects	6	11	3	1	23
Total	32	46	14	35	250

Table IX: Shows different types of NTDs comparison with other studies reported.

reported a prospective study of 100 cases of polyhydramnios selected for USG to detect etiological factors, over 1 & ½ yrs [1999 2000] 40 % had congenital anomalies. Among 40 cases, CNS anomalies were seen in 21 cases and 14 were NTDs. Higher incidence of CNS anomalies and NTDs were observed here because of screening done for high risk cases.

Dhapate S.S.et al [2007][4] reported a study done to detect NTDs with the help of USG. A total of 8640 women attending the antenatal clinic who were referred for routine USG screening were included in the study. Craniospinal anomalies were seen in 35 cases, giving the incidence of 0.40 %. Among the craniospinal anomalies anencephaly cases were 17 giving the incidence of 48.57 %.

Balakumar K. [2007][3] reported analysis of incidence of major fetal anomalies using USG, in Northern Kerala. USG was done for 30,030 cases for the period of 15 yrs and 7 months. There were 857 anomalous foetuses [2.59%], 336 CNS anomalies [39.20%], 250 cases with NTDs [17.26%].

Sania Tanveer et al [2008][5] reported a study, done in Peshawar among 3310 deliveries, NTDs were seen in 46 cases [1.39%], 21 cases had hydrocephalus, 6 had anencephaly, 8 babies had spina bifida with meningomyelocele & 11 with multiple system involvement. Incidence of NTDs is almost same as the present study except number of babies with multiple system involvement is higher in this study. Recurrence of NTDs was not observed in the present study. Jayesh Sheth et al [2003][7] reported a case of non consanguineous married couple with recurrent meningomyelocele in four pregnancies. Neelam Banergee, et al [2002][8] reported a case of recurrent neural tube defects in successive pregnancies.

Table VI: Shows comparison of incidence of NTDs with studies reported.

In the present study incidence of NTDs per 1000 births is almost same as the study reported by Sania Tanveer[5] and Balakumar K.[3], whereas very higher incidence is reported by Reddi Rani and low incidence is reported by Dhapate S.S.

Table VII: Showing comparison of different types of NTDs and Age group with study reported by Sania Tanveer.

There were more number of cases with hydrocephalus in Saniya Tanveer study than the present study. Number of NTDs associated with multiple system involvement is also more than the present study. As many as 11 cases are reported among > 40 years age in Sania Tanveer study and none in the present study.

Table VIII: Comparison of gestational age with NTDs with Dhapate S.S. study.

More number of cases [23] seen among age group of >29 years in our study and more number [18] seen in age group of 21-28 years in study reported by Dhapate S.S.

Table IX: Shows different types of NTDs compared with other study reported.

Anencephaly is the commonest NTDs in our study and study by Dhapate S.S.[4] Hydrocephalus with spina bifida is more common in study by Sania Tanveer[5]. Hydrocephalus & anencephaly are almost equal in study reported by Balakumar K[3].

CONCLUSION

In the present study incidence of NTDs is 10.66 per 1000 births. There is high incidence here probably due to poor intake of Folic acid & Vitamin B12 during periconceptional period and no facility for early USG for diagnosis and counselling. Neural tube defects are associated with considerable morbidity and are also a major cause of perinatal mortality. Anencephaly is not compatible with life. Infants with

spina bifida have different prognosis, if the lesion over the spinal cord is not closed infants usually succumb within first few days of life. Closure of the defect produces a situation compatible with long term survival, if associated hydrocephaly is treated with shunting device. Long term prognosis depends on degree of neurological involvement. Intellectual outcome depends on complications related to hydrocephalus specially infections following shunt procedure.

Micronutrients especially folic acid decreased levels delay the closure of neural tube. Neural defects are the result of aberrant expression of a yet unidentified development gene or family of genes. Doubling of the risk of spina bifida has been associated with homozygosity for 5, 10 Methelenetetrahydrofolate reductase, the C6777 allelic variant [Poonam Singh 2008[9].

Many studies conducted regarding the effect of Folic acid and vitamin B12 proved beyond doubt in reducing the incidence of NTDs by 73 %.Our goal should be to prevent NTDs by supplementing Folic acid & Vitamin B12, during periconceptional period.

Prenatal diagnosis by screening protocols, like Amniocentesis done around 15 20 weeks for estimation of AFP and is found to be raised in 95 % of cases. Prenatal USG is ideal around 16 -20 wks. Absence of calvaria, non fusion of foetal spine is diagnostic of NTDs. AFP values are expressed as Multiple Of Median [MOM].If maternal serum AFP is > 2.00 MOM screening for NTD is done. Prenatal surgery [in utero] is tried for spinal defect, meningomyelocele babies in advanced countries.

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