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Original Research

Foetal Ultrasound– A Study of Spina Bifida and Associated Anomalies in Rural Pregnant Women

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ABSTRACT

Objective: To study the incidence and various types of associated anomalies and complications on obstetric ultrasound, in rural pregnant women. To reduce the maternal morbidity and mortality by early detection of these congenital neuroectodermal anomalies. To assist the obstetrician in taking decisions regarding the termination or continuation of the pregnancy in relation to the type of malformation and its prognosis. A prospective and retrospective study of spina bifida and its associated anomalies was done on 23,000 rural pregnant women coming to the Santhiram Medical College, Radiology Department for a routine obstetric scan. A total of 19 cases spina bifida were detected of which 2 cases were pure spina bifida without any complication, 14 cases had hydrocephalus and meningocele or myelomeningocele and 2 cases had meningocele without hydrocephalus. One case had anencephaly with an incidence of 1 per 1,111 cases. History of similar anomaly and intake of iron and folic acid tablets were noted. Ultrasound is an excellent modality for the diagnosis and characterisation of these neuroectodermal anomalies. Its multiplanar imaging property along with real-time image visualization makes it an excellent tool for the diagnosis and characterization of these anomalies.

KEYWORDS: Congenital neuroectodermal anomalies, Spina bifida, Hydrocephalus, Meningocele, Myelomeningocele, Ultrasound, Anencephaly

AIMS AND OBJECTIVES

Primary: To study spina bifida and various types of its associated congenital neuroectodermal anomalies on obstetric ultrasound in rural pregnant women.

To calculate the incidence and prevalence of these anomalies, in these rural pregnant women.

INTRODUCTION

The three primary germ cell layers of the embryo are ectoderm, mesoderm and endoderm. The ectoderm is again divided into surface ectoderm and neural ectoderm. This neural ectoderm is again of two varieties, one is the neural crest and another is the neural tube [1–3]. The derivatives of the neural tube are brain (rhombencephalon, mesencephalon and prosencephalon), spinal cord and motor neurons, retina and posterior pituitary. Congenital neuroectodermal anomalies are one of the most common anomalies occurring in the foetus. These anomalies are most often derived from the neural tube, rather than neural crest. The defects at caudal end of neural tube give rise to spina bifida.

(Q05) Spina bifida

- Meningocele (spinal)
- Meningomyelocele
- Myelocele
- Rachischisis

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METHODOLOGY

This cross-sectional study of congenital neuroectodermal anomalies on antenatal ultrasound comprised a total of 23,000 pregnant women who came for routine antenatal scans to the inpatient and outpatient departments of Santhiram General Hospital, Nandyal.

The study was conducted from October 2011 to April 2016. Pregnant women underwent routine antenatal ultrasound in the Department of Radio diagnosis.

Inclusion Criteria

All pregnant women with intrauterine pregnancy of gestational age ranged from 12 weeks to Post-term cases.

Exclusion Criteria

1. Pregnant women with gestational age less than 11 weeks.
2. Extra uterine pregnancies.

The present study was a retrospective and prospective study done for a period of 55 months starting from 1 October 2011 to April 2016.

Approximately 23,000 antenatal scans were performed during the above-mentioned period of study.

A total of 19 cases out of the 23,000 antenatal scans showed spina bifida and its associated anomalies.

Approximately 0.08% of the total cases showed this anomaly and its associated anomalies.

PERCENTAGE OF TOTAL ANOMALIES

One in approximately every 1,222 cases showed the anomaly.

Spina bifida associated with mylocelesmeningoceles and myelomeningoceles, hydrocephalus chiari malformation hydroneprosis associated with spina bifida,

The 19 diagnosed anomalies were distributed as follows:

Spina bifidaand Meningocele + MMC + Hydrocephalus Hydrocphalus MMYL with Hydrocephalus Menigocele + Mylocele	**14 Cases**
Spina bifida with myelomenigocele or menigocele	2 Cases
Spina bifidawithoutother anomaly	2 Cases
Spina bifidawith anencephaly	1 Cases
Hydronephrosis	6 Cases
Polyhydromnios	5 Cases

Out of the 19 cases, 14 cases of spina bifida associated with hydrocephalus and meningocele or/and menigomyelocele, there were two cases of spina bifida with either meningomyelocele or meningocele without hydrocephalus, two cases were spina bifida (Figure 1) without myelocele or meningocele or hydrocephalus and one case of spina bifida with anencephaly.

The case with the thoracic meningocele showed associated polyhydramnios, abnormally thin placenta and single umbilical artery.

Hydrocephalus associated with spina bifida in six cases showed the characteristic lemon-shaped (Figure 3) skull and seven cases showed banana sign of cerebellum (Figure 2). This banana sign of cerebellum is s/o chiari malformation.

The spina bifida was noted at various levels. A total of 3 cases showed spina bifida at the thoracolumbar region, 1 case showed spina bifida at the mid thoracic region and the rest of the 15 cases showed defect in the lower lumbar region.

Of the19 cases of spina bifida, 4 cases did not show any associated meningoceles or myelomeningoceles, of these 2 had mild hydro cephalus, 6 cases showed myelomeningoceles (Figure 4) and 10 cases showed meningoceles.

Out of the 19 cases of spina bifida, 6 cases were associated with polyhydramnios, 7 case showed typical lemon shaped skull, 7 cases showed banana sign of cerebellum (chiari malformation), 6cases showed mild

hydronephros is with 1case of anencephaly with spina bifida noted. A total of 14 cases showed hydrocephalus (Figure 5), 1 case showed single umbilical artery and 16cases showed associated meningoceles/ myelomeningoceles.

Of the 19 cases with anomalies, 4 cases had history of consanguinity (22% of cases).

Of the 19 cases, 6 cases (31%) had history of intake of Iron and Folic acid tablets. In the rest of the 13 cases, no history of intake of iron and folic acid tablets.

Out of these cases, the age group of the mother was less than 20 years in two cases (both showing spina bifida with hydrocephalus) and more than 30 years in one case, which showed severe hydrocephalus. The rest of 16 cases belonged to age group between 20 and 30 years.

Age Group	Number of Anomalies	Percentage
Less than 20 years	2	11%
Between 20 and 30 years	16	84
More than 30 years	1	5%

Of the 19 cases, 10 cases (52%) were primi cases, and the remaining 9 cases (48%) were multigravida cases.

Thus, more number of cases were noted in primi cases rather than multigravida women.

Of all the 19 cases, 5 cases showed polyhydramnios.

Oligohydramnios was not observed in any case.

DISCUSSION

Ultrasound is an excellent modality to diagnose and characterise foetal anomalies more so neuroectodermal anomalies, in particular spina bifida, meningocele, myelocele and hydrocephalus. Use of 3D and 4D imaging helps further. It is cost-effective [4]. Ultrasound is the imaging modality of choice for antenatal ultrasound.

In this study of 23,000 cases of antenatal ultrasound at gestational ages ranging from 12 weeks to post-term pregnancies, 19 foetuses with spina bifida associated hydrocephalus [5] and myelomeningocele or meningocele,14. Spin bifida with myelomenigocele or meningocele two and only spina bifida in two cases. One case showed anencephaly. The incidence was calculated to be 0.08 per 1,000 cases or one for every 1,222 cases.

Eighteen of the 95%cases were detected in women between the ages of 18 and 30 years, with only one noted in woman aged more than 30 years. Congenital neuroectodermal [6] anomalies are more common in women whose age is more than 30–35 years, which is not reflected in this present study because most of the pregnant women who took part in the study were between 20 and 30 years. This is due to the fact that most of these rural women get married very early.

Out of the 19 anomalies identified, the most common anomalies detected were hydrocephalus and spina bifida [7] with meningocele and myelomenigocele [8] seen in14 cases (73%). Four cases showed severe hydrocephalus with communication between both lateral ventricles and dangling choroid sign [9]. The other 10 cases showed lateral ventricular diameter 15 and 16mm. Of these 14 cases, 4 showed myelomeningocele and 10 showed meningocele. Spina bifida was seen in 2 out of 19 cases with myelomenigocele or meningocele without hydrocephalus. Two cases did not show any associated meningoceles or myelomeningoceles.

The spina bifida was noted at various levels. 3cases showed spina bifida at the thoracic region, 1 case showed spina bifida at the mid thoracic region and the rest of the 15 cases showed defect in the lower lumbar region. This finding supports the fact that most common location for meningoceles or meningomyeloceles (Figure 6) is the lower lumbar region [10].

7 of these 14 cases with hydrocephalus showed the typical banana-shaped cerebellum (chiari

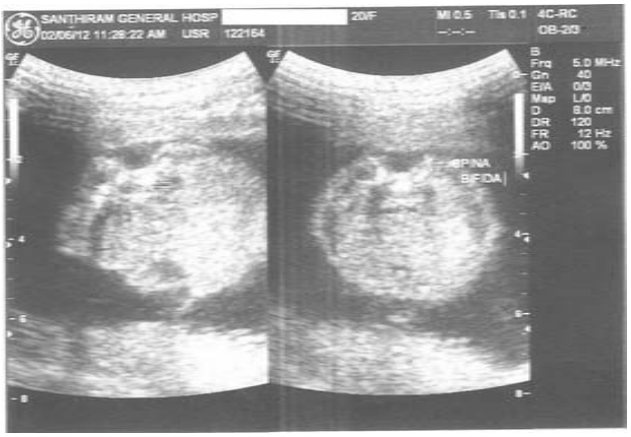

Figure 1: Spina bifida in a 21-wk old foetus

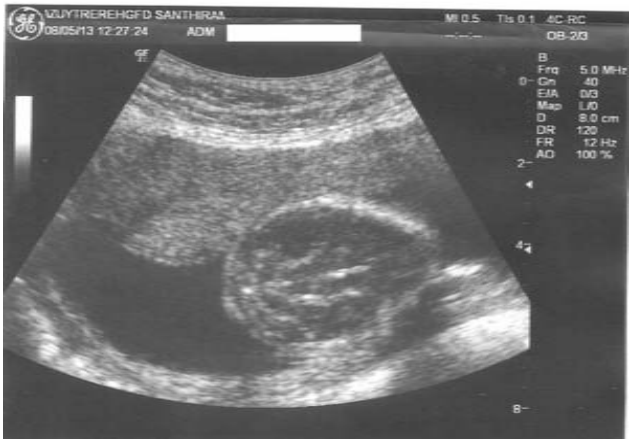

Figure 2: A 30 wk foetus with spina bifida showing the banana sign

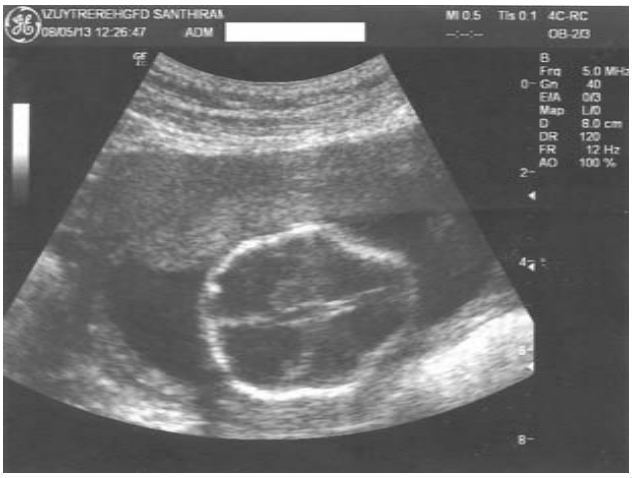

Figure 3: Lemon sign in the same foetus shown above

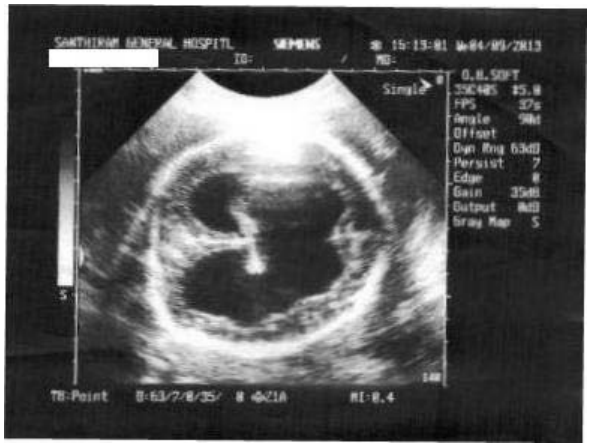

Figure 4: Foetus showing severe hydrocephalus in foetus with spina bipida and mylocele

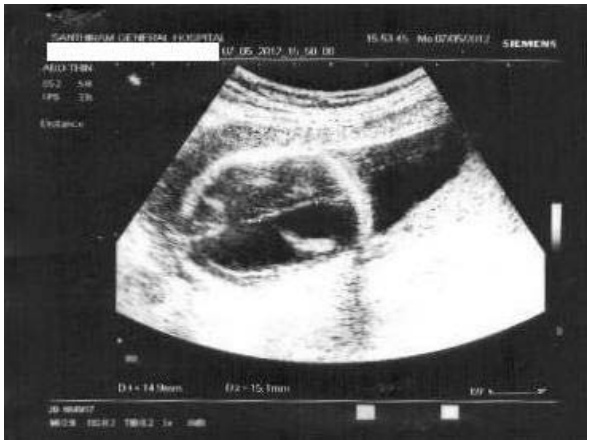

Figure 5: Foetus showing hydrocephalus with dangling choroid sign

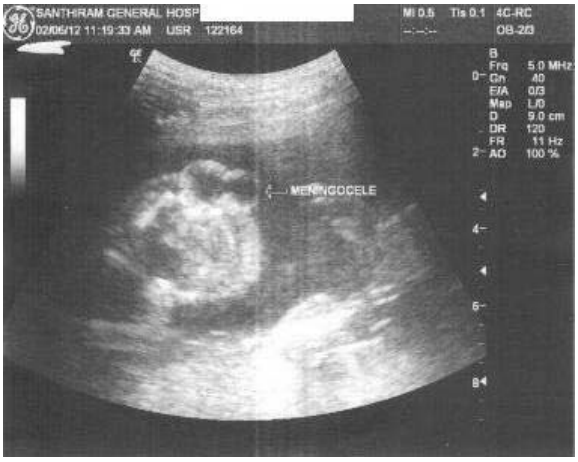

Figure 6: Foetus showing meningocele

malformation). None of these seven cases showed any evidence of syringomylia [11]. Even though microcephaly is said to be common in these cases, we noticed only one such association. The internal translucency that is compressed fourth ventricle was noted in these seven cases. Seven cases showed the typical lemon-shaped skull. Of these 19 cases, 9 mothers gave history consanguinity. An indication is that consanguineous marriage plays a definite role in these anomalies.

Associated Anomaly	No. of Cases	Perce-ntage
Total number of pregnant women included in study	23,000	
Number of positive cases with spina bifida and other associated anomalies	19	0.08
Hydrocephalus	14	73
Myelomeningocele	6	32
Meningocele	11	58
Chiari malformation	7	37
Anencephaly	1	5
Hydroneprosis	6	32

This comparative study table shows closely related numerical data and also reiterates certain facts that the spina bifida is a common anomaly. Hydrocephalus is common associated finding followed by meningocele [12], chiari malformation, hydroneprosis and myelomeningocele.

CONCLUSION

- Excellent characterisation of this congenital spina bifida anomaly is possible with ultrasound.
- Early diagnosis of these foetal spina bifida anomalies can be done by using ultrasound, sometimes as early as second trimester.
- Incidence and prevalence of these congenital spin bifida anomalies can be measured by using ultrasound.
- Common lesions detected were hydrocephalus, myelomenigocele and meningocelechiari malformation in that order associated with spina bifida.
- The most common site of spina bifida/meningocele/ meningomyelocele was the lower lumbar vertebrae.

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