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**Original Article**

# Frequency of Spinal Defects in Fetuses with Ventriculomegaly

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## ABSTRACT

Fetal ventriculomegaly (VM) is a dilation of the lateral ventricle. Different patients have different etiologies for fetal ventriculomegaly, which can be idiopathic, structural, or chromosomal. A measurement of 10–15 mm is commonly referred to as mild ventriculomegaly, while measurements of 15–20 and >20 mm and above are defined as moderate and severe ventriculomegaly. **Objective:** To find the frequency of spinal defects (SD) in fetuses with ventriculomegaly (VM). **Methods:** It was a cross-sectional analytical study which included 103 pregnant ladies who had evidence of ventriculomegaly visited multiple centers during research period. Convenient sampling method was used. The presence of ventriculomegaly was confirmed using transabdominal probe with frequency 3-5 MHz. Frequency was calculated and crosstabs were made using SPSS version 21.0. **Results:** Among 103 pregnant patients, frequency of fetal spinal defects was 25.2%. Frequency of ventriculomegaly was as follow: mild ventriculomegaly 43.7%, moderate ventriculomegaly 31.2%, and severe ventriculomegaly 25.2%. Among 103 patients, 25.2% patients had AFI greater than 21. Frequency of mother's H/O any fetal spinal defects in their previous pregnancies was 15.5%. **Conclusions:** The study concluded that frequency of spinal defects in fetuses with ventriculomegaly was 25.2% and spinal defects occur in those patients who had severe ventriculomegaly (>20mm) and had AFI greater than 25.

## INTRODUCTION

Ventriculomegaly, a general sonographic sign that is present in a variety of clinical entities with various prognoses, is the dilatation of the fetal cerebral ventricles [1]. Different patients have different etiologies for fetal ventriculomegaly, which can be idiopathic, structural, or chromosomal. The three main causes of fetal ventriculomegaly are loss of cerebral tissue, ventricular system blockage, and excessive CSF production. Brain tissue is lost as a result of cerebral atrophy, giving the ventricles an expanded appearance. It typically causes imbalance between the two lateral ventricles and may originate from infections, metabolic problems, cerebral hypoxia, or infarction. Aqueductal stenosis (AS), or narrowing of the cerebral aqueduct, is a common cause of obstruction. It can be brought on by X-linked hydrocephalus, infection with subsequent aqueduct fibrosis, or intraventricular hemorrhage. Of patients with fetal ventriculomegaly, 22.5 % experience it. Cortical malformations, brain masses, or migrational anomalies are some additional reasons of prenatal ventriculomegaly. In some circumstances, the fetal ventricular itself may be used as a marker for severe brain defects, genetic abnormalities, infections, or CNS diseases [2]. CNS abnormalities are frequently linked to fetal



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ventriculomegaly (agenesis of the corpus callosum, spina bifida). Severe ventriculomegaly is linked to non-CNS abnormalities in 30% of instances. When ventriculomegaly is accompanied by other fetal defects, chromosomal anomalies are found in more than 15% of instances [3]. Structural aberrations can be anywhere between 10% and 76 % in mild Ventriculomegaly. Malformations are discovered after birth in 13% of cases, even in ventriculomegaly that appears to be isolated. A high mortality rate is related with ventriculomegaly when it coexists with other brain malformations. Poor prognostic indicators are early ventriculomegaly detection and progression. 20 % of cases with isolated moderate ventriculomegaly have bad outcomes, and 1.4% of those cases result in neonatal death. Chromosome abnormalities are seen in 3% of cases with isolated mild ventriculomegaly [4]. According to a recent study, ACC and spina bifida were the most frequent related anomalies with severe ventriculomegaly (60%), although non-CNS malformations made up roughly one-third of all diagnosed anomalies [5]. Ventricles begin to form within the brain during the fifth week of embryonic life [6]. The alterations of the ventricular system diameters, or the distance between each ventricle's walls, had been theorized to be the cause of an increase in the fetal skull dimension [7]. In most cases of ventricular dilatation, an increase in the size of the anterior horn of the lateral ventricle occurs first in its anteroposterior portion. The ventricular hemisphere Ratio may still be normal at this stage of ventricular dilatation and be ineffective for making an early diagnosis of ventricular dilatation [8]. Early ventriculomegaly (occurring before 24 weeks) is significantly associated with high spinal defects and severe ventriculomegaly at the end of pregnancy [9]. Fetal ventriculomegaly can also be characterized as unilateral, bilateral, isolated, or non-isolated [10]. The probability of survival with normal neurodevelopment is greater than 90% in isolated ventriculomegaly measuring 10–12 mm. The possibility of normal neurodevelopment with moderate ventriculomegaly is 75-93% [11]. In terms of survival and neurodevelopmental outcome, fetuses with severe ventriculomegaly have a poor prognosis [12]. The ultrasound findings for the diagnosis of ventriculomegaly are: Anechoic visualization of the third and fourth ventricles with fluid, choroid-plexus to "dangle" with the ventricular trium, over-imposing ventricular boundary notices in the occipital horn and trigon areas [13]. Spina bifida is the most common central nervous system malformation. It is a vertebral median defect with external spinal cord exposure [14]. Open or closed congenital spinal abnormalities can be distinguished with certainty. Open spinal deformities make up the great majority of them. Prenatal diagnoses are typically made after routine scanning in low-risk patients [15]. Closed spina bifida accounts for about 15% of all cases and consist of a small defect that is entirely covered by normal skin. This condition is frequently asymptomatic and is diagnosed incidentally or after a radiological scan of the column. Instead, open spina bifida is the most common lesion, accounting for 85% of all cases. The spinal cord may be exposed, or the defect may be covered by the meningeal membranes [16]. When neural tube fails to close properly early in gestation, the caudal cell mass develops abnormally, resulting in a variety of congenital spinal deformities known as neural tube defects (NTD). Prenatal ultrasound (US) can detect spinal abnormalities, linked CNS and non-CNS defects (cardiac, skeletal), and can also gauge fetal growth and wellbeing [17]. There are over 140000 cases of neural tube defects reported annually worldwide [18]. While spina bifida affects roughly 0.5 out of every 1000 babies born worldwide [19]. In pregnancy there may be a lot of associated complications in fetus because of ventriculomegaly and spinal defects before and after birth such as central-nervous-system abnormalities, non-central-nervous-system structural abnormality, chromosomal abnormality, fetal infection, traumatic birth, difficult delivery of the baby and hydrocephalus. The purpose of this study was to assess the frequency of spinal defects in fetuses with ventriculomegaly while most of the ventriculomegaly is referred to legal abortion. In case of ventriculomegaly with spinal defects, legal abortion is necessary because fetus cannot be able to survive as pregnancy advances. In our study we had found that how many fetuses had ventriculomegaly with spinal defects.

## METHODS

It was a cross sectional study performed to find out the frequency of spinal defects in fetuses with ventriculomegaly. We reviewed 103 such cases who had fetal ventriculomegaly and then we analyzed that how many fetuses had spinal defects also. Convenient sampling technique was used. The duration of data collection was 6 months and data was collected from Multiple Centers according to the variables such as gestational age, parity, AFI, fetal presentation and included all the patients with evidence of fetal spinal defects, ventriculomegaly and those patients were also included who had previous history of fetal spinal defects. Women in 1st trimester of pregnancy and with history of diabetes mellitus or hypertension were excluded. Sonographic evaluation was performed by using Transabdominal probe with frequency 3-5 MHz. Frequency was calculated and crosstabs were made using SPSS version 21.0.

## RESULTS

In this study 103 patients came with evidence of


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ventriculomegaly in the radiology department of Multiple Centers. Among 103 pregnant patients, frequency of fetal spinal defects was 25.2%. Frequency of ventriculomegaly was as follow: mild ventriculomegaly 43.7%, moderate ventriculomegaly 31.2%, and severe ventriculomegaly 25.2%. Among 103 patients, 25.2% patients had AFI greater than 21. Frequency of mother's H/O any fetal spinal defects in their previous pregnancies was 15.5%.

| Variables | Categories | Frequency(%) |
|---|---|---|
| Parity | 1.00 | 47(45.6%) |
| | 2.00 | 37(35.9%) |
| | 3.00 | 16(15.5%) |
| | 4.00 | 3(2.9%) |
| Presentation | Breech | 29(28.2%) |
| | Cephalic | 74(71.8%) |
| Ventriculomegaly | Mild | 45(43.7%) |
| | Moderate | 32(31.1%) |
| | Severe | 26(25.2%) |
| Spina Bifida | No | 77(74.8%) |
| | Yes | 26(25.2%) |
| Mother's H/O any fetal spinaldefect | No | 87(84.5%) |
| | Yes\ | 16(15.5%) |

**Table 1:** Shows variables and their frequencies

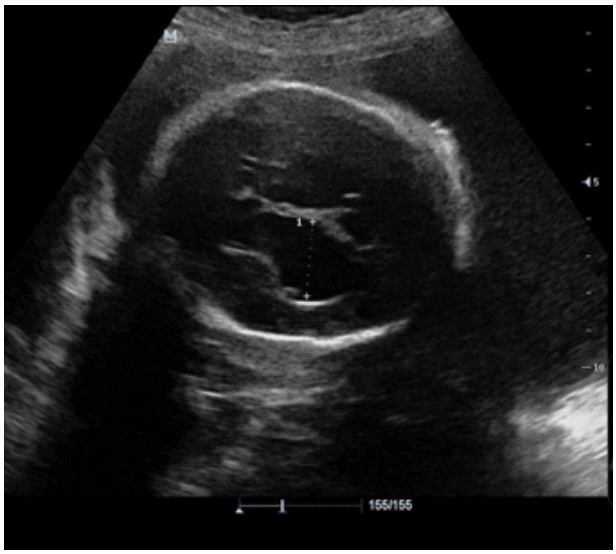

**Figure 1:** Ultrasound image showing fetal brain having bilateral and severe ventriculomegaly at 30 weeks and 4 days of gestation.

**Table 2:** Describes the cross tabulation of Fetal Presentation and Ventriculomegaly, It describes that 10 (34.4%) fetuses had mild, 10 (34.4%) had moderate and 9 (31.0%) had severe ventriculomegaly with breech presentation. While 35(47.2%) had mild, 22 (29.7%) had moderate and 17(22.9%) had severe ventriculomegaly with cephalic presentation.

| Count | | | | | |
|---|---|---|---|---|---|
| | | Ventriculomegaly | | | Total |
| | | Mild | Moderate | Severe | |
| Presentation | Breech | 10(34.4%) | 10(34.4%) | 9(31.0%) | 29(100%) |
| | Cephalic | 35(47.2%) | 22(29.7%) | 17(22.9%) | 74(100%) |
| Total | | 45(43.6%) | 32(31.0%) | 26(25.2%) | 103(100%) |

**Table 2:** Presentation Ventriculomegaly Comparison

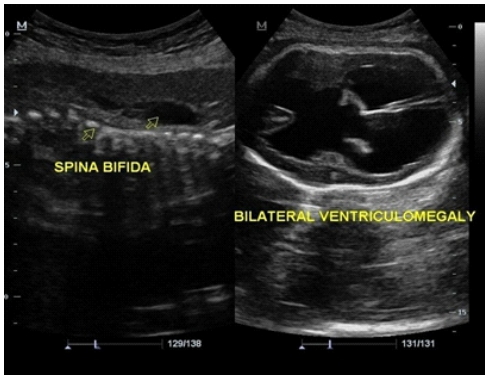


**Figure 2:** Ultrasound images of fetal spine and fetal head. Image on left side demonstrate spina bifida in fetus. Image on right side demonstrate severe bilateral ventriculomegaly.

Table 3: Describes the cross tabulation of Fetal Presentation and Spina Bifida, it describes that 9 (31.0%) fetuses had Spina Bifida with breech presentation. While 17 (22.9%) had Spina Bifida with cephalic presentation out of 103(100%)fetus

| Count | | | | |
|---|---|---|---|---|
| | | Spina Bifida | | Total |
| | | No | Yes | |
| Presentation | Breech | 20(68.9%) | 9(31.0%) | 29(100%) |
| | Cephalic | 57(77.0% | 17(22.9%) | 74(100%) |
| Total | | )77(74.7%) | 26(25.2%) | 103(100%) |

**Table 3:** Presentation *Spina Bifida Comparison

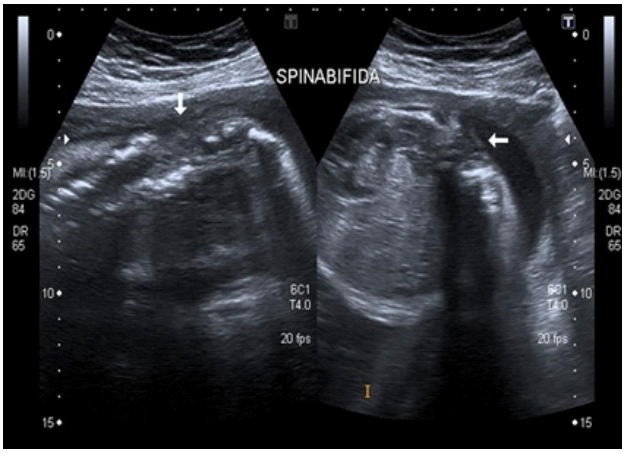


**Figure 3:** Ultrasound images of fetal spine shows spina bifida at 29 weeks of gestation



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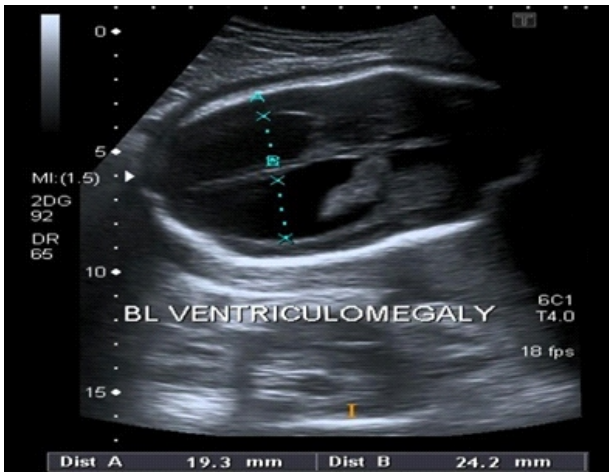


**Figure 4:** Ultrasound image of fetal head demonstrate bilateral ventriculomegaly measuring 19.3mm and 24.2mm

## DISCUSSION

Our study was designed to find the frequency of spinal defects in fetuses with ventriculomegaly. In pregnancy there may be a lot of associated complications in fetus because of ventriculomegaly and spinal defects before and after birth such as central-nervous-system abnormalities, non-central-nervous-system structural abnormality, chromosomal abnormality, fetal infection, traumatic birth, difficult delivery of the baby and hydrocephalus. We reviewed 103 such cases who had fetal ventriculomegaly and then we analyzed that how many fetuses had spinal defects also. Table 1 of our study display variables and their frequencies. Our analysis displays the parity with a minimum of 1 and a maximum of 4. 103 patients were divided such as 47 patients were with parity 1, 37 patients were with parity 2, 16patients were with parity 3, and 3 patients were with parity 4. At the time of the scan, 74 of the 103 patient's fetuses were cephalic and 29 of them were breech. Fetal ventriculomegaly is a dilation of the lateral ventricle. One of the most frequent findings on second-trimester obstetrical ultrasound examinations is fetal ventriculomegaly, which is generally defined as a transtrigone measurement of more than or equal to 10 mm at any point in pregnancy. Ventriculomegaly can be caused by a variety of disorders which results in neurological, motor, and/or cognitive disorders impairment [20]. Mild ventriculomegaly is typically described as a measurement between 10 and 15 millimeters, whereas moderate and severe ventriculomegaly are characterized as measures between 15 and 20 millimeters and above [21]. One of the important strength of our study was that we analyzed the data of patients separately according to the degree of ventriculomegaly such as mild, moderate and severe. By analyzing of data separately we found that spinal defects were found in cases of severe ventriculomegaly (width of the atria of the lateral ventricles >20mm). Our study shows that out of 103 fetuses, 45 (43.7%) fetuses had mild ventriculomegaly, 32 (31.1%) had moderate ventriculomegaly and 26 (25.2%) had severe ventriculomegaly. Our investigation shows fetal spina bifida in patients who had severe ventriculomegaly and AFI greater than 25. It shows that out of 103 fetuses, 26 (25.2%) had Spinal defects of different types. Further, our research found that out of 103 Pregnant Women, 16 patients had history of fetal spinal defect in their previous pregnancies while 87 had not history of any fetal spinal defect. Moreover, our study describes that 35 (60.3%) fetuses had mild and 23 (39.6%) had moderate ventriculomegaly with AFI less than 15. Further describes that 10 (52.6%) had mild and 9 (47.3%) had moderate ventriculomegaly with AFI of 16 to 20. while 26 (100.0%) fetuses had severe ventriculomegaly with AFI greater than 21.

## CONCLUSIONS

The research concluded that frequency of spinal defects in fetuses with ventriculomegaly was 25.2% and spinal defects occur in those patients who had severe ventriculomegaly (>20mm) and had AFI greater than 25.

## Conflicts of Interest

The authors declare no conflict of interest.

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