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Original Article

Frequency of Ventriculomegaly in Fetuses With Spina Bifida During 2nd and 3rd Trimester of Prgnancy

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ABSTRACT

Background: Ventriculomegaly is a frequent intracranial finding in fetuses with open spina bifida and may influence prenatal evaluation and counselling. Objective: To determine the frequency of ventriculomegaly and describe ventricular width and lesion level in fetuses with spina bifida during the second and third trimesters. Methods: A descriptive cross-sectional ultrasound study included 30 pregnancies with fetal spina bifida. Maternal age, gestational age, trimester, fetal presentation, spinal-lesion level, ventriculomegaly status, and ventricular width were summarized using frequencies, percentages, means, standard deviations, and ranges. Results: Mean maternal age was 28.07 ± 3.97 years and mean gestational age was 29.83 ± 5.36 weeks. Twenty-two examinations (73.3%) occurred in the third trimester. The lesion was lumbar in 14 fetuses (46.7%), sacral in 7 (23.3%), lumbosacral in 5 (16.7%), and thoracolumbar in 4 (13.3%). Ventriculomegaly was recorded in 23 fetuses (76.7%). Mean ventricular width across the sample was 12.93 ± 3.00 mm (range 8.00–18.00 mm). Conclusion: Ventriculomegaly was common in this small sonographic series of fetuses with spina bifida, and the lumbar region was the most frequent lesion level. Larger prospective studies with standardized neurosonography and outcome follow-up are required. Keywords: ventriculomegaly; spina bifida; prenatal ultrasound; fetal anomaly; ventricular width.

INTRODUCTION

Fetal ventriculomegaly is defined by an atrial width of at least 10 mm on prenatal ultrasound and is commonly classified as mild, moderate, or severe according to ventricular measurement (1). Its clinical significance varies with severity, progression, laterality, gestational age, and the presence of associated structural or genetic abnormalities. Even apparently mild or isolated ventriculomegaly may require detailed neurosonography and follow-up because additional abnormalities can alter prognosis and counselling (2). Ventriculomegaly is also associated with increased risks of adverse perinatal and neurodevelopmental outcomes, particularly when severe or progressive (3).

Spina bifida results from incomplete closure of the neural tube and includes a spectrum ranging from closed vertebral defects to open lesions containing meninges and neural tissue. Open spina bifida is frequently accompanied by hindbrain and supratentorial abnormalities, including Chiari II malformation and enlargement of the lateral ventricles (4). Ventricular changes may become more evident after the first trimester, and most fetuses with open spina bifida show enlarged lateral ventricles later in gestation (5). Cerebrospinal-fluid leakage through the spinal defect, altered posterior-fossa anatomy, and impaired circulation may contribute to progressive ventricular dilatation (6,7).

Prenatal ultrasound is the primary modality for detecting spina bifida, identifying the level of the spinal lesion, and measuring the cerebral ventricular atrium. Accurate measurement is clinically important

because lesion level and ventricular size may influence eligibility for fetal intervention, anticipated need for postnatal cerebrospinal-fluid diversion, and neurological prognosis (6,8). When ventriculomegaly is detected, a systematic examination of the intracranial anatomy and spine is required, and serial assessment may be used to identify progression (1,9,10).

Published prenatal studies have described an association between fetal spinal defects and ventriculomegaly, but the reported frequency varies with referral setting, gestational age, imaging protocol, lesion type, and inclusion of associated anomalies (11,12). Local data from Pakistani obstetric imaging services remain limited. Establishing the proportion and severity of ventriculomegaly among fetuses already diagnosed with spina bifida may improve counselling, referral, surveillance, and multidisciplinary planning.

This study therefore aimed to determine the frequency of ventriculomegaly in fetuses with spina bifida during the second and third trimesters of pregnancy using prenatal ultrasonography. Secondary descriptive objectives were to characterize ventricular width and severity, gestational trimester, fetal presentation, and the anatomical level of the spinal lesion.

MATERIAL AND METHODS

A descriptive cross-sectional study was conducted over four months at Lady Willingdon Hospital, Lahore, and Tehsil Headquarters Hospital Kahana Nau, Lahore. The study population comprised pregnant women carrying fetuses diagnosed with spina bifida during the second or third trimester. Non-probability consecutive sampling was used, and all eligible cases presenting during the study period were considered. Thirty pregnancies were included.

Pregnant women were eligible when prenatal ultrasound demonstrated fetal spina bifida and gestational age was within the second or third trimester. Fetuses with multiple congenital anomalies other than spina bifida were excluded. Gestational age in the analysed sample ranged from 20 to 39 weeks. Maternal age, gestational age, trimester, fetal presentation, level of the spinal lesion, presence of ventriculomegaly, ventricular width, and severity category were recorded using a structured data-collection form.

Ultrasound examinations were performed using a TOSHIBA Aplio 400 or SAMSUNG HS40 system with a 3.5-MHz convex transducer. The fetal spine was examined to confirm spina bifida and classify the lesion level as thoracolumbar, lumbar, lumbosacral, or sacral. Fetal presentation and gestational age were documented. The cerebral ventricular atrium was measured in millimetres on the standard axial plane. Ventriculomegaly was defined as an atrial width of at least 10 mm. Severity was categorized using the three-level system described in the manuscript: mild at 10-12 mm, moderate at 13-15 mm, and severe above 15 mm (1). Measurements below 10 mm were categorized as no ventriculomegaly.

Data were entered and analysed using IBM SPSS Statistics version 27.0. Maternal age, gestational age, and ventricular width were summarized using mean, standard deviation, minimum, and maximum. Trimester, fetal presentation, spinal lesion level, ventriculomegaly status, and severity were reported as frequencies and percentages. The primary analysis was the proportion of fetuses with ventriculomegaly among the 30 fetuses with spina bifida. Severity and ventricular-width distributions were presented descriptively using the same denominator and mutually exclusive categories. A two-sided p value of 0.05 was used as the threshold for statistical significance for any prespecified comparative analysis.

RESULTS

Thirty pregnancies with sonographically diagnosed fetal spina bifida were evaluated. Mean maternal age was 28.07 ± 3.97 years (range 21–35 years), and mean gestational age was 29.83 ± 5.36 weeks (range 20–39 weeks). Eight examinations (26.7%) were performed in the second trimester and 22 (73.3%) in the third trimester. Fetal presentation was cephalic in 16 cases (53.3%) and breech in 14 (46.7%).

Table 1. Maternal and pregnancy characteristics (n = 30)

Characteristic	Value	Range
Maternal age, years	28.07 ± 3.97	21–35
Gestational age, weeks	29.83 ± 5.36	20–39
Second trimester	8 (26.7)	
Third trimester	22 (73.3)	
Cephalic presentation	16 (53.3)	
Breech presentation	14 (46.7)	

Values are mean ± SD, n (%), or range.

The lumbar region was the most frequent spina-bifida level (14, 46.7%), followed by the sacral (7, 23.3%), lumbosacral (5, 16.7%), and thoracolumbar (4, 13.3%) regions. Ventriculomegaly was recorded in 23 fetuses (76.7%). Across the full sample, mean ventricular width was 12.93 ± 3.00 mm, with values ranging from 8.00 to 18.00 mm.

Table 2. Fetal ultrasonographic findings (n = 30)

Variable	Category/statistic	Value
Spina-bifida level	Thoracolumbar	4 (13.3)
	Lumbar	14 (46.7)
	Lumbosacral	5 (16.7)
	Sacral	7 (23.3)
Ventriculomegaly	Present	23 (76.7)
	Absent	7 (23.3)
Ventricular width, mm	Mean ± SD	12.93 ± 3.00
	Range	8.00–18.00

DISCUSSION

Ventriculomegaly was recorded in 23 of 30 fetuses with sonographically diagnosed spina bifida, corresponding to a frequency of 76.7% in this selected clinical series. The mean ventricular width across the complete sample was 12.93 mm, with measurements from 8 to 18 mm. The lumbar region was the most frequent spinal-lesion level, followed by sacral, lumbosacral, and thoracolumbar locations. These findings support the close anatomical and developmental relationship between open spinal dysraphism and enlargement of the lateral ventricles, but they should be interpreted as descriptive frequencies among referred affected pregnancies rather than population incidence.

Ventricular enlargement is well recognized in fetal spina bifida, particularly in association with altered posterior-fossa anatomy and Chiari II malformation. Cerebrospinal-fluid leakage through the spinal defect, hindbrain displacement, impaired flow, and evolving intracranial pressure may contribute to ventricular dilatation. Reviews and prenatal-counselling guidance emphasize that the significance of ventriculomegaly depends on measurement, progression, laterality, gestational age, and associated structural or genetic abnormalities (3,11–13). The present study did not characterize these additional determinants, but the high observed frequency reinforces the need for systematic intracranial assessment whenever a spinal defect is detected.

The predominance of lumbar lesions is compatible with reports that lumbosacral and lumbar levels are common in prenatal and postnatal spina-bifida cohorts. Diagnostic accuracy for lesion level is clinically relevant because level may relate to motor function, bladder and bowel outcomes, hindbrain changes, eligibility for fetal surgery, and postnatal cerebrospinal-fluid diversion (1,8,13,26). However, the current study did not compare prenatal level with operative, postnatal, or MRI confirmation. The level distribution should therefore be regarded as the ultrasound classification recorded at the study examination.

Previous regional work has reported ventriculomegaly during second- and third-trimester assessment and spinal defects among fetuses with ventricular enlargement (10,17). International studies have also described associated supratentorial abnormalities, progression of ventricular size, and the prognostic importance of additional findings (14,18,27,34,40). Direct numerical comparison is difficult because referral patterns, case definitions, gestational age, imaging technique, inclusion of isolated versus non-

isolated ventriculomegaly, and ascertainment of open versus closed spina bifida vary considerably. The current sample included only fetuses already diagnosed with spina bifida, so its 76.7% frequency cannot be compared with studies beginning from an unselected obstetric population.

The original manuscript reported severity-group tests and comparisons of ventricular width according to ventriculomegaly status. Those inferential results should not be used to claim an independent biological relationship because ventriculomegaly status and severity were defined from the same ventricular-width measurement. A wider ventricle will necessarily fall into a higher category, making a test of width against its own derived category mathematically circular. In addition, the severity table total did not reconcile with the reported 23 cases of ventriculomegaly. The revised interpretation therefore relies on the internally consistent descriptive findings: 23 affected fetuses and an overall ventricular-width mean of 12.93 ± 3.00 mm.

Clinically, detection of spina bifida should prompt standardized neurosonography including atrial ventricular width, posterior-fossa and hindbrain anatomy, corpus callosum, laterality, other central-nervous-system findings, extracranial anomalies, and serial assessment where appropriate. Guidelines for mild ventriculomegaly also support detailed anatomical evaluation and consideration of genetic and infectious investigations according to presentation (11,30). Counselling should integrate lesion level, ventricular evolution, associated anomalies, gestational age, local fetal-therapy options, and postnatal neurosurgical resources rather than relying on ventricular width alone.

The study is limited by its sample of 30 pregnancies, descriptive cross-sectional design, facility-based recruitment, and restriction to the second and third trimesters. The report did not describe interobserver reproducibility, blinding, measurement repetition, laterality, progression, posterior-fossa findings, genetic testing, fetal MRI, pregnancy outcome, postnatal confirmation, or neurodevelopment. The use of two ultrasound systems may introduce measurement variability if acquisition was not standardized. The inconsistent severity and ventriculomegaly totals and the circular inferential analyses further restrict interpretation. Future prospective multicentre studies should use a prespecified measurement protocol, reconcile all denominators, assess reliability, document associated abnormalities, and link prenatal measurements with pregnancy, surgical, shunt, and neurodevelopmental outcomes.

CONCLUSION

In this descriptive series of 30 fetuses with spina bifida, ventriculomegaly was recorded in 76.7%, mean ventricular width was 12.93 ± 3.00 mm, and the lumbar region was the most frequent lesion level. These findings support routine measurement of the lateral ventricular atrium during comprehensive prenatal evaluation of spina bifida. Severity-based inferential claims are not supported because the source totals were inconsistent and the categories were derived from ventricular width itself. Larger prospective studies with standardized neurosonography, reliability assessment, and postnatal outcome follow-up are needed.

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