DOI: https://doi.org/10.54393/pjhs.v4i02.465

PAKISTAN JOURNAL OF HEALTH SCIENCES
https://thejas.com.pk/index.php/pjhs
Volume 4, Issue 2 (February 2023)

Original Article

Ultrasonographic Findings of Ventriculomegaly in 2nd And 3rd Trimester with Fetal Outcomes

Saba Feroz[1], Noraiz Ali[1*], Zain ul Hasan[1], Zareen Fatima[1], Nadia Hina[1], Arsal Jahangeer[1], Manahil Gill[1], Ayesha Arshad[1] and Areeba Rouf[1]

[1]University Institute of Radiological Sciences and Medical Imaging Technology, The University of Lahore, Lahore, Pakistan

ARTICLE INFO

Key Words:
Ventriculomegaly (VM), Spinal defects (SD), Ultrasonography(USG)

How to Cite:
Feroz, S. ., Ali, N., Ul Hasan, Z., Fatima, Z. ., Hina, N., Jahangir, A., Gill, M., Arshad, A., & Rouf, A. (2023). The Ultrasonographic Findings of Ventriculomegaly in 2nd And 3rd Trimester with Fetal Outcomes: Ultrasonographic Findings of Ventriculomegaly . Pakistan Journal of Health Sciences, 4(02). https://doi.org/10.54393/pjhs.v4i02.465

***Corresponding Author:**
Noraiz Ali
University Institute of Radiological Sciences and Medical Imaging Technology, The University of Lahore, Lahore, Pakistan
noraiz.ali@rsmi.uol.edu.pk

Received Date: 27th December, 2022
Acceptance Date: 8th February, 2023
Published Date: 28th February, 2023

ABSTRACT

In the second trimester, fetal ventriculomegaly is a typical finding on obstetrical ultrasonography. It is clinically relevant since it can be caused by a variety of disorders that cause brain, motor, and/or cognitive impairment. Many cases are associated with other abnormalities, but in other cases, ventriculomegaly is the only abnormality. **Objective:** To evaluate the incidence of ventriculomegaly in 2nd and 3rd trimester with fetal outcomes. **Methods:** A descriptive study was conducted at of University of Lahore Ultrasound Clinic Greentown for duration of 4 months. Total 774 females were presented at hospital for in 2nd and 3rd trimester. All participants underwent transabdominal ultrasound using 3-5 MHz curvilinear probe. Written informed consent was obtained from all participants. **Results:** Total 774 women in 2nd and 3rd trimester of their pregnancy were included in our study. Out of 774 patients 700 were with cephalic presentation and 74 were with breech presentation. Variables including Spinal defect types, ventriculomegaly and ventricular involvement were noted. Out of 774 patients, 22 patients had fetal ventriculomegaly, 2 patients were with meningocele, 3 were with myelomeningocele and 16 patients were with spina bifida occluta. Ventricular involvement was as follow: In 5 fetuses, fourth ventricle was involved, in 15 fetuses lateral ventricles were involved and in 2 fetuses third ventricle was involved. **Conclusion:** Findings from this study concluded that Severity of ventriculomegaly is highly associated with fetal spinal defects.

INTRODUCTION

Fetal cerebral ventriculomegaly is a common finding on obstetrical ultrasonography in the second trimester. It is clinically significant since it can be caused by a wide range of illnesses that produce neurological, motor, and/or brain damage. Many instances are coupled with additional aberrant features, however ventriculomegaly is the lone abnormality in some pregnancies [1]. Between 15 and 40 weeks of gestation, atrial diameter stays constant [2, 3]. Depending on the research, ventriculomegaly is defined as an atrial diameter of ten millimeters which is 2.5 to four standard deviations above the mean [4]. Ventriculomegaly is termed mild if the atrial diameter is between 10 and 15 mm, and severe if the atrial diameter is greater than 15 mm, while some writers use the subcategories of mild (10 to 12 mm), moderate (13 to 15 mm), and severe (16 mm) 1. Although the incidence of ventriculomegaly is even less than 2%, data vary substantially within that range [5]. In one investigation, among 5400 standard prenatal sonographic tests performed between 16 and 22 weeks of gestation, eight occurrences of mild unexplained lateral ventriculomegaly were discovered (prevalence 1 in 675) [6]. This is an accurate estimate of the frequency in a general obstetric population receiving second trimester prenatal sonography. Males are more likely to develop ventriculomegaly; the male-to-female sex ratio is 1.7 [7]. A thorough assessment necessitates further imaging of the

DOI: https://doi.org/10.54393/pjhs.v4i02.465

CNS beyond what is covered in the baseline obstetrical ultrasonography. A complete examination of the lateral, 3rd, and 4th ventricles; corpus callosum; thalami; germinal matrix area; and cerebellum and cerebellar vermis would be included in such imaging [8]. Compared to the second trimester, ventriculomegaly is not well defined in the first trimester. This might be due to the rare occurrence in early pregnancy. Relation between ventriculomegaly and spinal defects had already been proven. The purpose of this study was to evaluate the overall adverse fetal outcomes caused by ventriculomegaly.

METHODS

A 7-month descriptive research was carried out at the University of Lahore Teaching Hospital's Radiology Department. The research included women in their second and third trimesters of pregnancy who presented for a normal ultrasound check. Women in their first trimester of pregnancy were not allowed to participate. After receiving written informed permission, all females had ultrasonography. Women were lying on their right side. For the exam, the sofa was modified. To apply the gel, the lower abdomen was exposed. Transabdominal probe frequency 3-5 MHz was utilized for the exam, with the preset changed according to the patient's gestation age and BMI. The ISOUG 6 step scan procedure was followed. To observe the head, the probe was put in a transverse position on the lower abdomen. The head circumference, head shape, and ventricle size were all measured. The spine was then traced using a longitudinally rotating probe, and additional biometric measures were taken. Data were evaluated and analyzed with Statistical Software for Social Sciences version 24.0.s

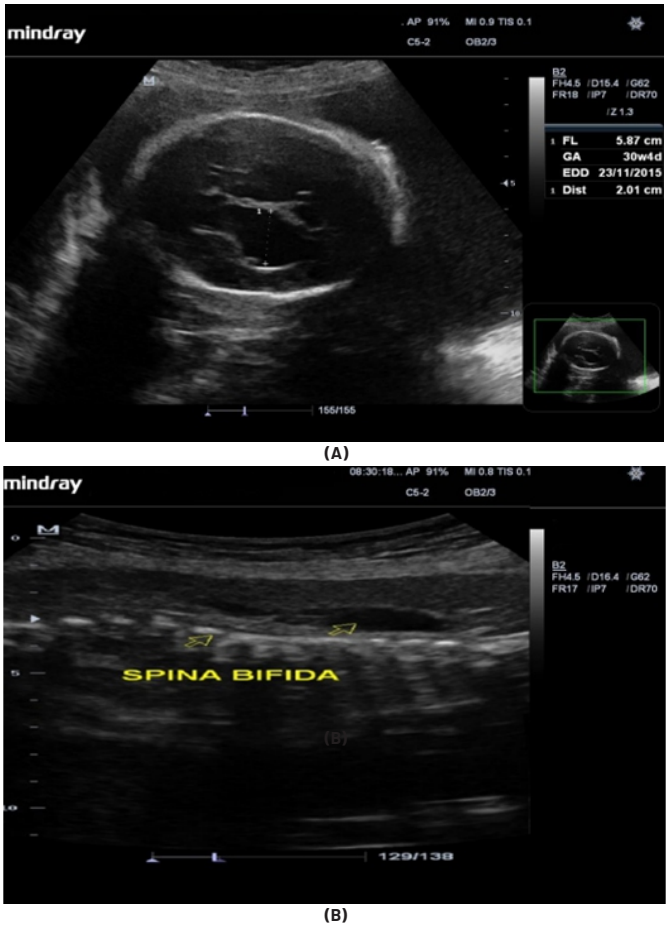
RESULTS

Total 774 women in 2nd and 3rd trimester of their pregnancy were included in our study. Out of 774 patients 700 were with cephalic presentation and 74 were with breech presentation. Variables including Spinal defect types, ventriculomegaly and ventricular involvement were noted. Ventricular involvement was as follow: In 5 fetuses, fourth ventricle was involved, in 15 fetuses lateral ventricles were involved and in 2 fetuses third ventricle was involved. Out of 774(100.0%) patients, 752(97.2%) had no fetal ventriculomegaly while 22(2.8%) had fetal ventriculomegaly. Out of these patients who had no fetal ventriculomegaly, 28 patients had history of diabetes, 57 patients had history of hypertension while 1 patient had history of both diabetes and hypertension and 666 patients had no clinical history of diabetes and hypertension. Out of those 22(2.8%) patients who had fetal ventriculomegaly, 2 patients had history of diabetes while 10 had history of hypertension and 10 patients had no diabetes and hypertension. Table 1 show the Frequency distribution of fetal spinal defect types.

Spinal defect types	N (%)
Meningocele	2(0.3)
Myelomeningocele	3(0.4)
Spina Bifida Occulta	16(2.1)
None	753(97 3)
Total	774(100)

Table 1: Frequency distribution of fetal spinal defect types in included patients

Out of 774 patients, 22 patients had fetal ventriculomegaly (A) and 16 patients were with spina bifida occulta (B) (Figure 1).



(A)

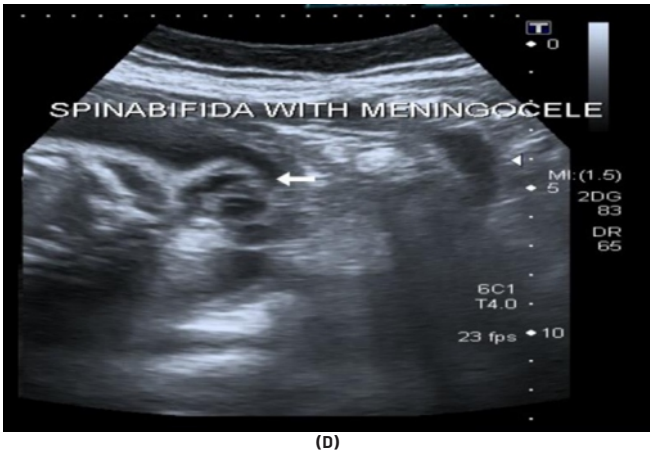
(B)

Figure 1: (A) Severe ventriculomegaly at 30 weeks of gestation, (B) Spina Bifida

Figure 2 (C) represent severe ventriculomegaly, and 2 patients were with meningocele (D).

DOI: https://doi.org/10.54393/pjhs.v4i02.465

(C)



(D)

Figure 2: (C) B/L severe ventriculomegaly, (D) Spina Bifida with Meningocele

DISCUSSION

The usual method for assessing foetuses for central nervous system (CNS) abnormalities is ultrasound imaging. While ultrasound is very good for this purpose in experienced hands, it is important to recognise that its diagnostic value can be limited due to the following factors: (1) the non-specific appearance of some anomalies; (2) technical factors that limit visualisation of the sides of the brain close the probe or the posterior fossa, the latter especially in late pregnancy due to cranial ossification; (3) subtle parenchymal abnormalities that cannot be seen by ultrasound; and (4) poor visuospatial contrast. All of these issues may have an impact on the precision with which fetal ventriculomegaly and accompanying malformations can be diagnosed [9]. However, even skilled hands might miss irregularities. Goldstein *et al.*, [10] examined the medical records of babies with an ultrasound diagnosis of moderate ventriculomegaly and discovered 11/30 (37%) undetected abnormalities. They did highlight, however, that the abnormalities missed in the majority of these cases were in babies with other detectable anomalies, therefore only one of the 11 (9%) mistakes led in misclassification in the isolated ventriculomegaly group vs the non-isolated ventriculomegaly group. Other studies find misclassification rates ranging from 0% to 10%. Assessed [11, 12]. Our study was designed to find the ultrasonographic frequency of fetal ventriculomegaly in 2nd and 3rd trimester of pregnancy. In pregnancy, there may be many associated complications in fetus because of ventriculomegaly 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 774 such cases who had 2nd and 3rd trimester of their pregnancy and then we analyzed how many fetuses had ventriculomegaly. Our research reveals that the minimum age of patient was 19 years and the maximum age was 37 years. At the time of the scan, it shows that out of 774 total patients, fetuses of 74(9.6%) patients were with the breech presentation while 700 (90.4%) were with cephalic presentation. Fetal ventriculomegaly is a dilation of the lateral ventricle [13]. In our study we found that a measurement of 10–15 mm was commonly referred to as mild ventriculomegaly, while measurements of 15–20 and >20 mm and above were defined as moderate and severe ventriculomegaly, respectively. Early ventriculomegaly (occurring before 24 weeks) is significantly associated with high risk of spinal defects and severe ventriculomegaly at the end of pregnancy [14]. One of the important strength of our study was that we analyzed the data of patients separately according to the ventricular involvement such as third, fourth and lateral ventricles. By analyzing of data separately, we found that spinal defects were also found in few cases. Studies indicate that prenatal ultrasound (US) can detect spinal abnormalities, linked CNS and non-CNS defects (cardiac, skeletal), and can also gauge fetal growth and well-being [15]. There are over 140000 cases of neural tube defects reported annually worldwide [16]. While spina bifida affects roughly 0.5 out of every 1000 babies born worldwide [17]. Masini *et al.*, examined all cases of spina bifida between February 1980 and December 2015. There were 222 cases of spina bifida with a 94.6 percent prenatal diagnosis rate. The researchers determined and described the prenatal diagnosis, natural history, and long-term outcome of a large contemporary cohort of spina bifida fetuses [18]. Out of 774 patients, spinal defect types were as follow: 2(0.3%) fetuses were with meningocele, 3(0.4%) fetuses were with myelomeningocele, 16(2.1%) fetuses were with spina bifida occluta and 753(97.3%) fetuses had no spinal defects. Yousaf *et al.*, studied 1492 female patients in cross-sectional research. A total of 1492 pregnant women between the ages of 18 and 40 weeks were studied. According to the findings of this study, the

DOI: https://doi.org/10.54393/pjhs.v4i02.465

degree of ventricular dilatation increases the likelihood of abnormalities. A total of seven instances of ventricular dilatation were discovered. Fetus with mild ventricular dilatation 1/7, 4/7 with moderate ventricle dilatation, 2/4 with moderate ventricle dilatation had neural tube abnormalities, and 2/7 with severe ventricle dilatation had neural tube malformations [19]. Out of 774(100.0%) patients, 22(2.8%) patients had fetal ventriculomegaly while 752(97.2%) had no fetal ventriculomegaly. It is shown that out of 774(100%) patients, ventricular involvement in fetuses was as follow: 5(0.6%) fetuses had ventricular involvement of fourth ventricle, 15(1.9%) fetuses had ventricular involvement of lateral ventricles, and 2 (0.3%) fetuses had ventricular involvement of third ventricle while 752 (97.2%) fetuses had no ventricular involvement. Zhao *et al.,* studied the discovery of chromosomal abnormalities during prenatal ultrasonography in fetuses with isolated ventriculomegaly. They concluded that there was a high chance of chromosomal abnormalities in fetuses with solitary ventriculomegaly, particularly if it was severe, bilateral, first present in mid-gestation, and did not go away [20]. Out of 774(100.0%) patients, 21(2.7%) patients had fetal spinal defects. History of diabetes there were 3 patients and with a history of hypertension there were 10 patients.753 (97.3%) patients had no fetal spinal defects rather out of those 753(97.3%) patients, 57 had a history of hypertension, 27 had a history of diabetes and 1 had a history of both diabetes and hypertension. Out of 21 patients who had fetal spinal defects, 10 patients had hypertension and three had diabetes. Patient clinical history and Spinal defect showed a statistically significant association with value of $p < 0.0001$. Out of 774(100.0%) patients, 752(97.2%) had no fetal ventriculomegaly while 22(2.8%) had fetal ventriculomegaly. Out of these patients who had no fetal ventriculomegaly, 28 patients had a history of diabetes, 57 patients had a history of hypertension while one patient had a history of both diabetes and hypertension and 666 patients had no clinical history of diabetes and hypertension. Out of those 22(2.8%) patients who had fetal ventriculomegaly, 2 patients had a history of diabetes while 10 had a history of hypertension and 10 patients had no diabetes and hypertension. Patient clinical history and ventriculomegaly showed a statistically significant association with value of $p < 0.0001$. Out of 774(100.0%) patients, 752(97.2%) patients had no fetal ventriculomegaly while 22(2.8%) patients had fetal ventriculomegaly. Out of those 752(97.2%) patients, 750 Patients had no fetal spinal defects while two patients were with fetal spinal defects. Out of those 22(2.8%) patients who had fetal ventriculomegaly, three patients had no spinal defects while 19 had spinal defects. Therefore, 21 patients had fetal spinal defects out of 774 while 753 had no spinal defects. The frequency of fetal ventriculomegaly in patients of 2nd and 3rd trimester of pregnancy was 2.8%.

CONCLUSIONS

Findings from this study concluded that Severity of ventriculomegaly is highly associated with fetal spinal defects.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

REFERENCE

[1] Griffiths PD, Reeves MJ, Morris JE, Mason G, Russell SA, Paley MN, *et al*. A prospective study of fetuses with isolated ventriculomegaly investigated by antenatal sonography and in utero MR imaging. American Journal of Neuroradiology. 2010 Jan; 31(1): 106-11. doi: 10.3174/ajnr.A1767

[2] Cardoza JD, Goldstein RB, Filly RA. Exclusion of fetal ventriculomegaly with a single measurement: the width of the lateral ventricular atrium. Radiology. 1988 Dec; 169(3): 711-4. doi: 10.1148/radiology.169.3.3055034

[3] Goldstein I, Reece E, Pilu G-L, Hobbins J. Sonographic Evaluation of the Normal Developmental Anatomy of Fetal Cerebral Ventricles. IV.: The Posterior Horn. American Journal of Perinatology. 1990 Jan; 7(01): 79–83. doi: 10.1055/s-2007-999452

[4] Farrell TA, Hertzberg BS, Kliewer MA, Harris L, Paine SS. Fetal lateral ventricles: reassessment of normal values for atrial diameter at US. Radiology. 1994 Nov; 193(2): 409-11. doi: 10.1148/radiology.193.2.7972754

[5] Alagappan R, Browning PD, Laorr A, McGahan JP. Distal lateral ventricular atrium: reevaluation of normal range. Radiology. 1994 Nov; 193(2): 405-8. doi: 10.1148/radiology.193.2.7972753

[6] Achiron R, Schimmel M, Achiron A, Mashiach S. Fetal mild idiopathic lateral ventriculomegaly: is there a correlation with fetal trisomy?. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 1993 Mar; 3(2): 89-92. doi: 10.1046/j.1469-0705.1993.03020089.x

[7] Melchiorre K, Bhide A, Gika AD, Pilu G, Papageorghiou AT. Counseling in isolated mild fetal ventriculomegaly. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2009 Aug; 34(2): 212-24. doi: 10.1002/uog.7307

DOI: https://doi.org/10.54393/pjhs.v4i02.465

[8] Malinger G, Paladini D, Haratz KK, Monteagudo A, Pilu GL, Timor-Tritsch IE. Practice Guidelines (updated): sonographic examination of the fetal central nervous system. Part 1: performance of screening examination and indications for targeted neurosonography. Ultrasound Obstetric & Gynecology. 2020 Sep; 56(3): 476-84. doi: 10.1002/uog.22145

[9] Filly RA, Goldstein RB, Callen PW. Fetal ventricle: importance in routine obstetric sonography. Radiology. 1991 Oct; 181(1): 1-7. doi: 10.1148/radiology.181.1.1887016

[10] Goldstein RB, La Pidus AS, Filly RA, Cardoza J. Mild lateral cerebral ventricular dilatation in utero: clinical significance and prognosis. Radiology. 1990 Jul; 176(1): 237-42. doi: 10.1148/radiology.176.1.2191365

[11] Bromley B, Frigoletto FD, Benacerraf BR. Mild fetal lateral cerebral ventriculomegaly: clinical course and outcome. American Journal of Obstetric Gynecology. 1991 Mar; 164(3): 863e7. doi: 10.1016/0002-9378(91)90530-5

[12] Patel MD, Filly AL, Hersch DR, Goldstein RB. Isolated mild fetal cerebral ventriculomegaly: clinical course and outcome. Radiology. 1994 Sep; 192(3): 759e64. doi: 10.1148/radiology.192.3.7520183

[13] Almog B, Gamzu R, Achiron R, Fainaru O, Zalel Y. Fetal lateral ventricular width: what should be its upper limit? A prospective cohort study and reanalysis of the current and previous data. Journal of Ultrasound in Medicine. 2003 Jan; 22(1): 39-43. doi: 10.7863/jum.2003.22.1.39

[14] Giardini V, Verderio M, Cozzolino S, Vergani P. Isolated spina bifida aperta: prenatal ventriculomegaly as an ultrasound prognostic marker. Prenatal Diagnosis. 2019 Oct; 39(11): 1035-7. doi:10.1002/pd.5509

[15] Morris JE, Rickard S, Paley MN, Griffiths PD, Rigby A, Whitby EH. The value of in-utero magnetic resonance imaging in ultrasound diagnosed foetal isolated cerebral ventriculomegaly. Clinical Radiology. 2007 Feb; 62(2): 140-4. doi: 10.1016/j.crad.2006.06.016

[16] Copp AJ, Adzick NS, Chitty LS, Fletcher JM, Holmbeck GN, Shaw GM. Spina bifida. Nature Reviews Disease Primers. 2015 Apr; 1(1) :15007. doi: 10.1038/nrdp.2015.7

[17] Mohd-Zin SW, Marwan AI, Abou Chaar MK, Ahmad-Annuar A, Abdul-Aziz NM. Spina bifida: pathogenesis, mechanisms, and genes in mice and humans. Scientifica. 2017 Feb; 2017: 1-30. doi: 10.1155/2017/5364827

[18] Masini L, De Luca C, Noia G, Caruso A, Lanzone A, Rendeli C, *et al*. Prenatal diagnosis, natural history, postnatal treatment and outcome of 222 cases of spina bifida: experience of a tertiary center. Ultrasound in Obstetrics & Gynecology. 2019 Mar; 53(3): 302-8. doi: 10.1002/uog.20136

[19] Yousaf S, Khadija S, Asad N, Fatima M, GILANI SA, Laique T. Sonographic Association of Ventriculomegaly and Neural Tube Anomalies. Pakistan Journal of Medical and Health Sciences. 2021 May; 15(5): 1021-3. doi: 10.53350/pjmhs211551021

[20] Zhao D, Cai A, Wang B, Lu X, Meng L. Presence of chromosomal abnormalities in fetuses with isolated ventriculomegaly on prenatal ultrasound in China. Molecular Genetics & Genomic Medicine. 2018 Nov; 6(6): 1015-20. doi: 10.1002/mgg3.477