Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

ORIGINAL RESEARCH

Assessment of accuracy of ultrasound and magnetic resonance imaging in diagnosis of foetal congenital anomalies

[1]Dr. Anil Kumar Bansal, [2]Dr Anil Kumar Gupta

[1]Associate Professor, [2]Professor and Head, Dept of Radiology, FH Medical College and Hospital, Etmadpur, Agra, U.P., India

Correspondence:
Dr. Anil Kumar Bansal,
Associate Professor, Dept of Radiology, FH Medical College and Hospital, Etmadpur, Agra, U.P., India

Received: 18 September, 2022 Accepted: 18 October, 2022

Abstract

Background: Congenital anomalies can be defined as structural or functional anomalies, including metabolic disorders, which are present at the time of birth. The present study was conducted to assess accuracy of two-dimensional ultrasound and magnetic resonance imaging in diagnosis of foetal congenital anomalies.

Materials & Methods: 56 clinically suspected patients diagnosed to have congenital anomaly from 14-33 weeks Gestational Age (GA) by ultrasound underwent USG and MRI. Foetus MRI was done using single slice fast spin echo (HASTE) and gradient echo sequence (TRUFI) in various planes. The diagnoses obtained by sonography and MRI were collected and compared.

Results: Gestational age at diagnosis was 1st trimester seen in 12, 2nd trimester in 20 and 3rd trimester in 24. Parity was G1 in 24, G2 in 21 and G3 in 11. Risk factors were present in 26 and absent in 30. The difference was significant (P< 0.05). Out of 56 females, congenital cardiovascular anomalies were ASD in 15, VSD in 10, complex CHD in 1, single ventricle in 5, Noonan syndrome in 2 and giant right atrium in 1 case. The difference was significant (P< 0.05). USG and MRI had sensitivity of 86.4% and 87.9%, specificity of 76.5% and 67.3%, PPV of 81.4% and 96.7%, NPV of 45.7% and 36.4% and diagnostic accuracy of 86.2% and 90.2% respectively. The difference was significant (P< 0.05).

Conclusion: Both ultrasound and foetus MRI are highly sensitive and specific in diagnosis of congenital anomalies of the foetus. The additional information provided by foetus MRI would have led to a change in counseling and/or management.

Key words: Congenital anomalies, USG, MRI

Introduction

Congenital anomalies can be defined as structural or functional anomalies, including metabolic disorders, which are present at the time of birth. An approximately 303,000 neonatal deaths occur globally each year due to congenital malformations.[1] The prevalence rate of congenital anomalies in India is 6-7%, CVS anomalies followed by CNS anomalies. According to March of Dimes global report congenital foetus malformations are encountered in about 6% of all births.[2,3]

Over the past decade, the use of three-dimensional (3D) and four-dimensional (4D) fetal echocardiography has been introduced into clinical practice as a strategy to facilitate 2D fetal

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

echocardiography, with the hope of increasing detection of congenital heart defects, particularly with the use of algorithms that are intended to reduce operator dependency.[4]
Foetus MRI can corroborate doubtful ultrasound findings and thus add assurance in a meticulous prenatal diagnosis before performing interventional measures.[5] In vivo foetus MRI is the accurate adjunct tool to ultrasound, to characterise brain malformation, to identify different causes responsible for brain damage, and to document mechanisms responsible for brain injury and their consequences on the developing brain.[6] In about 60% of cases the aetiology of cerebral malformation remains unknown. MRI adds important additional information, particularly in foetuses in whom additional findings other than an enlarged ventricle are seen sonographically.[7] The present study was conducted to assess Accuracy of Two-dimensional Ultrasound and Magnetic Resonance Imaging in Diagnosis of Foetal Congenital Anomalies.

Materials & Methods

The present study consisted of 56 clinically suspected patients diagnosed to have congenital anomaly from 14-33 weeks Gestational Age (GA) by ultrasound. All agreed to participate in the study.
Data such as name, age etc. was recorded. All patients underwent USG and MRI. Foetus MRI was done using single slice fast spin echo (HASTE) and gradient echo sequence (TRUFI) in various planes. The diagnoses obtained by sonography and MRI were collected and compared. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

Table I Assessment of parameters

Parameters	Variables	Number	P value
Gestational age at diagnosis	1st trimester	12	0.17
	2nd trimester	20	
	3rd trimester	24	
Parity	G1	24	0.38
	G2	21	
	G3	11	
Risk factors	Present	26	0.92
	Absent	30	

Table I shows gestational age at diagnosis was 1st trimester seen in 12, 2nd trimester in 20 and 3rd trimester in 24. Parity was G1 in 24, G2 in 21 and G3 in 11. Risk factors were present in 26 and absent in 30. The difference was significant (P< 0.05).

Table II Cardiovascular anomalies

Parameters	Number	P value
ASD	15	0.01
VSD	10	
Complex CHD	1	
Single ventricle	5	
Noonan syndrome	2	
Giant right atrium	1	

Table II, graph I shows that out of 56 females, congenital cardiovascular anomalies were ASD in 15, VSD in 10, complex CHD in 1, single ventricle in 5, Noonan syndrome in 2 and giant right atrium in 1 case. The difference was significant (P< 0.05).

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Graph I Cardiovascular anomalies

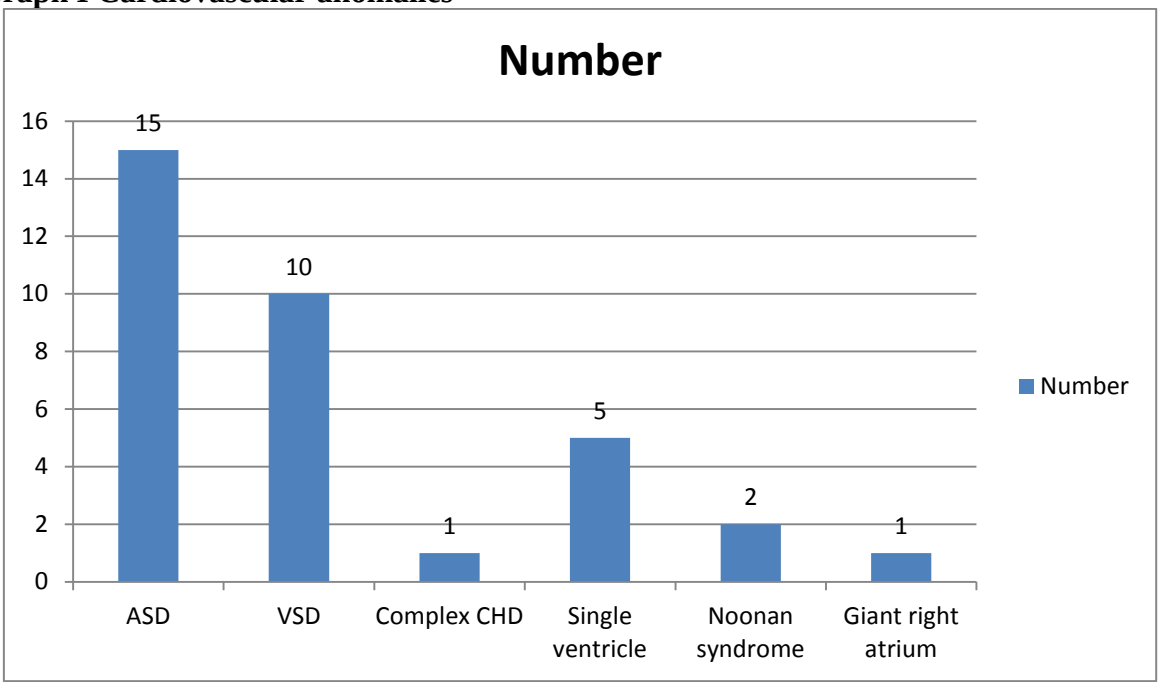

Table III Diagnostic accuracy of USG and MRI

Parameters	USG	MRI	P value
Sensitivity (%)	86.4	87.9	0.92
Specificity (%)	76.5	67.3	0.05
PPV (%)	81.4	96.7	0.02
NPV (%)	45.7	36.4	0.04
Diagnostic accuracy (%)	86.2	90.2	0.05

Table III shows that USG and MRI had sensitivity of 86.4% and 87.9%, specificity of 76.5% and 67.3%, PPV of 81.4% and 96.7%, NPV of 45.7% and 36.4% and diagnostic accuracy of 86.2% and 90.2% respectively. The difference was significant (P< 0.05).

Discussion

Ultrasound is the most important modality to evaluate the foetus. The excellence of ultrasound however, is unfavourably exaggerated by factors such as maternal obesity, unfavourable foetus position, decreased amniotic fluid or the near-field reverberation artifact.[8,9] The American College of Radiology (ACR) has stated that foetus MRI can be performed at any stage of pregnancy. However, it is better to perform the MRI after 17-18 weeks of gestation as there is a possible risk to the developing foetus as well as the extreme motion of younger foetus does not let us to carry out an MRI examination.[10,11] The present study was conducted to assess accuracy of two-dimensional ultrasound and magnetic resonance imaging in diagnosis of foetal congenital anomalies.

We found that gestational age at diagnosis was 1st trimester seen in 12, 2nd trimester in 20 and 3rd trimester in 24. Parity was G1 in 24, G2 in 21 and G3 in 11. Risk factors were present in 26 and absent in 30. Hamisa M et al[12] conducted a study on 23 pregnant women. In their study, they found that MRI and ultrasound showed similar findings in six cases. MRI changed the diagnosis in 14 cases and provided additional information in two cases. Ultrasound was superior to MRI in one case at the second trimester due to foetus motion

We observed that out of 56 females, congenital cardiovascular anomalies were ASD in 15, VSD in 10, complex CHD in 1, single ventricle in 5, Noonan syndrome in 2 and giant right atrium in 1 case. Wagner MW[13] concluded that secondary complications of the VGAM,

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

hemodynamic alterations such as cardiac failure, foetus hydrops, and brain injury. Heart failure results from increased cardiac preload secondary to arteriovenous shunts leads to cardiomegaly and hydrops foetusis. Injury to the cerebral gray and white matter is called "melting brain".

Ray et al[14] determined the accuracy of Ultrasound Sonography (USG) and High Field 3 tesla MRI in diagnosis of different types of foetal Central Nervous System (CNS) and non CNS congenital abnormalities. In cases with foetus anomalies high field MRI provided detailed findings leading to a more refined diagnosis. CNS anomalies were more as compared to other anomalies. Some of the antenatal findings were confirmed in some cases following termination of pregnancy and some were by postnatal examination. Among them chest anomalies was least common i.e., 1.5%. sensitivity of MRI was 88.13%, specificity was 66.66%, Positive Pressure Ventilation (PPV) was 96.29%, Negative Predictive Value (NPV) was 36.36% and USG sensitivity was 82.43%, specificity and 77.77%, PPV was 95.83%and NPV was 41.17%.

The limitation of the study is small sample size.

Conclusion

Authors found that both ultrasound and foetus MRI are highly sensitive and specific in diagnosis of congenital anomalies of the foetus. The additional information provided by foetus MRI would have led to a change in counseling and/or management.

References

1. Ganesh Rao B, Ramamurthy BS. MRI of the fetus brain. Indian J Radiol Imaging. 2009;19(1):69-74.
2. Denise P. Fetus MRI the sonographers view. Top Magn Reson Imaging. 2011;22(3):91-99.
3. Nadine J, Girard MD. Magnetic resonance imaging of fetus developmental anomalies. Top Magn Reson Imaging. 2011;22(1):11-23.
4. Benacerraf BR, Shipp TD, Bromley B, Levine D. What does magnetic resonance imaging add to the prenatal sonographic diagnosis of ventriculomegaly? J Ultrasound Med. 2007;26:1513-22. 5.
5. Kanal E, Borgstede JP, Barkovich AJ, Bell C, Bradley WG, Felmlee JP, et al. American College of Radiology White Paper on MR Safety. AJR Am J Roentgenol. 2002;178:1335-47.
6. Glenn OA, Barkovich AJ. Magnetic resonance imaging of the fetus brain and spine: An increasingly important tool in prenatal diagnosis. AJNR Am J Neuroradiol. 2006;27:1604-11.
7. Gonçalves LF, Lee W, Mody S, Shetty A, H Sangi-Haghpeykar AH, Romero R. Diagnostic accuracy of ultrasonography and magnetic resonance imaging for the detection of fetus anomalies: A blinded case-control study. Ultrasound Obstet Gynecol. 2016;48(2):185-92.
8. Gupta P, Kumar S, Sharma R, Gadodia A, Roy KK, Sharma JB. Role of magnetic resonance imaging in fetus renal anomalies. International Journal of Gynecology and Obstetrics. 2010;111:209.
9. Hussamy DJ, Herrera LC, Twickler DM, Mcintire DD, Dashe JS. Number of risk factors in down syndrome pregnancies. Am J Perinatol. 2019;36(1):79-85.
10. Yong Seak S, Myung Joon K, Ja young K, Young-han K, Yong-won P. The Usefulness of Fetal MRI for Prenatal Diagnosis. Yonsei Med J. 2007;31;48(4):671-77.
11. Blaicher W, Prayer D, Bernaschek G. magnetic resonance imaging and ultrasound in the assessment of the fetal central nervous system. J Perinat Med. 2003. 2003;31(6): 459-68.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

12. Hamisa M, Dabees N, Ataalla WM, Ziada DH. Magnetic resonance imaging versus Ultrasound examination in detection of prenatal fetus brain anomalies. Egypt J Radiol Nucl Med. 2013;44:665-72.
13. Wagner MW, Vaught AJ, Poretti A, Blakemore KJ, Huisman TAJM. Vein of galen aneurysmal malformation: Prognostic markers depicted on fetus MRI. Neuroradiol J. 2015;28(1):72-75.
14. RAY J, BAIDYA J, DEBBARMA T, JOY J. Accuracy of Two-Dimensional Ultrasound and Magnetic Resonance Imaging in Diagnosis of Foetal Congenital Anomalies in a Tertiary Care Hospital-A Cross-sectional Study. Journal of Clinical & Diagnostic Research. 2021 Jul 1;15(7).