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ORIGINAL ARTICLE

Retrospective Study

Accuracy of ultrasonography in diagnosis of fetal central nervous system malformation

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Abstract

BACKGROUND

Prenatal examination is an important measure for the screening and diagnosis of fetal malformations.

AIM

To investigate the accuracy of ultrasonography in the diagnosis of fetal central nervous system (CNS) malformations.

METHODS

One hundred and thirteen pregnant women suspected of having fetal CNS malformations were examined at our hospital from December 2018 to October 2020 using two-dimensional ultrasonography and three-dimensional ultrasonography, respectively.

RESULTS

According to the pathological results, there were 79 cases of CNS malformations and 34 cases of non-CNS malformations among the 113 pregnant women suspected of having fetal CNS malformation. Fifty-one cases of CNS malformation and 26 cases of non-CNS malformation were detected by two-dimensional ultrasonography, and 73 cases of CNS malformation and 30 cases of non-CNS malformation were detected by three-dimensional ultrasonography. The diagnostic sensitivity (92.41%) and accuracy (91.15%) of three-dimensional ultrasonography were higher than those of two-dimensional ultrasonography (64.56% and 68.14%, respectively) (P = 0.000). The specificity of three-dimensional

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ultrasonography (88.24%) was higher than that of two-dimensional ultrasonography (76.47%); however, the difference was not significant (P = 0.203).

CONCLUSION

Three-dimensional ultrasonography has high application value in the diagnosis of fetal CNS malformations. In addition, the image quality is clear, and the diagnostic sensitivity and accuracy are high.

Key Words: Ultrasonography; Fetal central nervous system malformation; Diagnostic accuracy; Screening; Diagnosis

Core Tip: Three-dimensional ultrasonography can show fetal morphology and structure and detect fetal intrauterine conditions, and has good repeatability and high sensitivity. This study selected 113 pregnant women suspected of having fetal central nervous system malformations with the aim to determine the application value of ultrasonography examination.

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INTRODUCTION

Birth defects are abnormalities in fetal body structure and function that occur in the uterus before delivery. They place a heavy burden on both children's family and society. As a consequence, increasing attention has been given to eugenics, improving population quality, and reducing birth defects in clinical settings[1,2]. At present, there are many known types of birth defects, among which, central nervous system (CNS) malformations have a high incidence and morbidity. Consequently, it is necessary to diagnose CNS malformations as efficiently and accurately as possible[1,3].

Prenatal examination is an important measure for the screening and diagnosis of fetal malformations. Ultrasonography has many advantages, such as being a noninvasive, safe, and simple procedure. We can observe the cross sections of the cerebellum, lateral ventricle, and thalamus to determine whether there is an abnormal intracranial structure. However, the diagnostic accuracy of conventional two-dimensional ultrasonography is still insufficient to meet the clinical expectations and actual needs[4,5].

Three-dimensional ultrasonography can show fetal morphology and structure and detect fetal intrauterine conditions, and has good repeatability and high sensitivity. It has been widely used for fetal malformation screening[6,7]. Thus, this study selected 113 pregnant women suspected of having fetal CNS malformations at our hospital with the aim to determine the application value of ultrasonography examination.

MATERIALS AND METHODS

General information

One hundred and thirteen pregnant women suspected of having fetal CNS malformations at our hospital from December 2018 to October 2020 were selected and included with the following criteria: (1) Singleton pregnancy; (2) Past history and health of pregnant women; (3) Good compliance and cooperation with the completion of related research and examination; and (4) Pregnant women and their families knew about this study and signed a consent form. The exclusion criteria were as follows: (1) Patients with hypertension during pregnancy; (2) Patients with depression, anxiety, and other psychological disorders; (3) Patients with a history of alcohol addiction; (4) Patients with a history of drug dependence; (5) Patients with a history of radioactive contact;

(6) Patients with speech communication disorders, hearing impairment, cognitive impairment, and neurological disorders; (7) Patients with a history of stillbirth or malformations; and (8) Patients with a history of spontaneous abortion of unknown cause.

Among the 113 pregnant women suspected of having fetal CNS malformations, there were 51 parturient women and 62 primipara, the average age was 30.96 ± 6.44 years (23-39 years), the average gestational age was 18.51 ± 5.06 weeks (13-24 wk), and the average body mass was 64.32 ± 10.08 kg (53.76-kg). This study was approved by the Ethics Committee of our hospital.

Methods

All patients were examined using two-dimensional ultrasonography and three-dimensional ultrasonography.

The Voluson E8 color Doppler ultrasonography diagnostic instrument from the American GE Company was selected. First, the abdominal convex array probe C1-5-D was adopted, and the probe frequency was set to 2.0 MHz. The lower abdomen was scanned, the median sagittal section image was obtained, the fetal head and arm length was measured, the fetal head and upper chest image was magnified as much as possible, the Vernier was adjusted slightly, and the transparent layer at the back of the neck and intracranial transparent layer were measured three times. In addition, the three-dimensional volume convex matrix probe RAB6-D was used; the probe frequency was set to 2.0 - 7.0 MHz, it was switched to 3D mode for reconstructing and obtaining three-dimensional images, multi-directional exploration according to the condition of the fetus was performed, and high-quality two-dimensional images were obtained. Starting with the three-dimensional imaging mode, the fetal spine, cerebellum, and skull were observed through the surface mode when amniotic fluid was sufficient. In addition, we explored the integrity of the skull, cerebellum, and spine through the transparent mode. The Y-axis, X-axis, and Z-axis were adjusted and the fetal CNS was observed through spatial rotation. Fetal development was recorded in detail. The fetal intracranial structure was observed according to the following contents: (1) Transverse section of the fetal skull (fetal thalamic structure, choroidal plexus structure, brain midline structure, skull halo structure, and skull biparietal diameter section); (2) Fetal cerebellar section (fourth ventricle structure, pellucid septum structure, posterior cranial fossa structure, cerebellum structure, and thalamus structure); (3) Spinal coronal, horizontal, and sagittal sections; and (4) Coronal and sagittal sections of the skull.

Observation indexes

The statistical image quality of two-dimensional ultrasonography and three-dimensional ultrasonography was assessed, including sulcus, fissure, and gyrus display, choroid plexus ependymal display, blood flow display, tissue specificity, resolution, visual field, and localization. If the tissue surface is not smooth, bone microstructure is not clear, spinal condition is not obvious, and image artifacts occur, it is scored one point. If the tissue surface is smooth, most of the bone microstructure is clear, there are a small number of artifacts in the image, and the spinal condition can be displayed, it is scored two points. In addition, if the surface tissue is smooth, the bone microstructure is clear, the image is free of artifacts, and the spinal condition can be clearly displayed, it is scored three points[1].

According to the results of the pathological examination (autopsy or postnatal results) as the gold standard, the diagnoses by two-dimensional ultrasonography and three-dimensional ultrasonography was statistically analyzed.

According to the results of pathological examination (autopsy or postnatal results) as the gold standard, the detection of different types of CNS malformations by two-dimensional and three-dimensional ultrasonography was statistically analyzed.

Statistical analysis

The data were analyzed using SPSS 22.0. Measurement data are described as the mean ± SD, and were analyzed by the Student's *t*-test. Counting data are described as the frequency and constituent ratio (%), and were analyzed using the χ^2 test. Non-parametric tests were used to compare the measurement data that did not meet a normal distribution. $P < 0.05$ indicated that the difference was statistically significant.

RESULTS

Image quality scores of two-dimensional ultrasonography and three-dimensional ultrasonography examination

Three-dimensional ultrasonography resulted in sulcus, fissure, and gyrus (2.53 ± 0.34), choroid plexus ependyma (2.49 ± 0.23), blood flow (2.38 ± 0.30), tissue specificity (2.44 ± 0.25), resolution (2.59 ± 0.18), visual field (2.63 ± 0.21), and localization scores (2.85 ± 0.12) that were higher than those of two-dimensional ultrasonography examination (1.97 ± 0.30, 2.12 ± 0.25, 1.98 ± 0.26, 2.03 ± 0.20, 2.31 ± 0.22, 2.25 ± 0.19, and 2.61 ± 0.14, respectively; P = 0.000) (Table 1).

Diagnoses by two-dimensional ultrasonography and three-dimensional ultrasonography

According to the pathological results, there were 79 cases of CNS malformations and 34 cases of non-CNS malformations among the 113 pregnant women suspected of having fetal CNS malformations. Fifty-one cases of CNS malformations and 26 cases of non-CNS malformations were detected by two-dimensional ultrasonography, whereas 73 cases of CNS malformations and 30 cases of non-CNS malformations were detected by three-dimensional ultrasonography, as shown in Table 2. The diagnostic sensitivity (92.41%) and accuracy (91.15%) of three-dimensional ultrasonography were higher than those of two-dimensional ultrasonography (64.56% and 68.14%, respectively) (P = 0.000). The specificity of three-dimensional ultrasonography (88.24%) was higher than that of two-dimensional ultrasonography (76.47%), but the difference was not significant (Table 3).

Analysis of different types of CNS malformations detected by two-dimensional and three-dimensional ultrasonography

Three-dimensional ultrasonography examination of brain perforation malformations (100%), corpus callosum abnormalities (75.00%), meningoencephalocele (100%), choroid cyst (85.71%), exposed brain malformation (88.89%), Galen venous hemangioma (100%), arachnoid cyst (91.67%), spina bifida (92.31%), and hydrocephalus (92.86%) showed no significant difference compared to two-dimensional ultrasonography (50.00%, 50.00%, 60.00%, 57.14%, 77.78%, 72.73%, 58.33%, 61.54%, and 71.43%, respectively; P = 0.102, 0.465, 0.114, 0.237, 0.527, 0.062, 0.059, 0.063, and 0.139, respectively) (Table 4).

DISCUSSION

The number of older pregnant women continues to increase with the implementation of the two-child policy in China. In addition, due to the effects of radiation, drugs, chemical reagents, chromosome variation, heredity, environmental pollution, dietary structure changes, and many other factors, the incidence of fetal malformations continues to increase[8,9]. CNS malformations, such as the vein of Galen malformation and exposed brain malformation, are a common group of fetal malformations. They increase not only the risk of perinatal death but also the family and social burden, even if the infant survives. Consequently, accurate diagnosis of fetal CNS malformations is still a research hotspot.

At present, there are many measures for screening fetal CNS malformations, including fetal tissue biopsy, fetal blood sample collection, chorionic cell sampling, and amniocentesis. However, they are all invasive examinations that can cause damage to the fetus, and their safety is low[10-13]. Moreover, ultrasonography is commonly used for fetal malformations, and two-dimensional ultrasonography has many advantages, such as real-time monitoring, low cost, simplicity, and a quick procedure. It has high diagnostic accuracy for obvious CNS malformations such as hydrocephalus, spina bifida, and encephalocele. However, it is difficult to detect fetal CNS malformations without obvious morphological changes. In addition, many factors, such as sound shadow, size of fetal bone, polyhydramnios, fetal movement, fetal position, the abdominal wall thickness of pregnant women, and many other factors, can affect the results of two-dimensional ultrasonography examination, resulting in a missed diagnosis or misdiagnosis and thus affecting the accuracy of diagnosis[14,15].

Table 1 Comparison of image quality scores between two-dimensional ultrasonography and three-dimensional ultrasonography (mean ± SD, points)

Group	Number	Sulcus, fissure, and gyrus display	Choroid plexus ependymal display	Blood flow display	Tissue specificity	Resolution	Visual field	Positioning
Two-dimensional ultrasonography	113	2.53 ± 0.34	2.49 ± 0.23	2.38 ± 0.30	2.44 ± 0.25	2.59 ± 0.18	2.63 ± 0.21	2.85 ± 0.12
Three-dimensional ultrasonography	113	1.97 ± 0.30	2.12 ± 0.25	1.98 ± 0.26	2.03 ± 0.20	2.31 ± 0.22	2.25 ± 0.19	2.61 ± 0.14
t		13.129	11.578	10.711	13.613	10.471	14.264	13.836
P value		0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 2 Analysis of diagnoses by two-dimensional ultrasonography and three-dimensional ultrasonography

Inspection mode		Results of pathological examination		Total
		+	-	
Two-dimensional ultrasonography examination	+	51	8	59
	-	28	26	54
Three-dimensional ultrasonography examination	+	73	4	77
	-	6	30	36
	Total	79	34	113

Table 3 Diagnostic performance of two-dimensional ultrasonography and three-dimensional ultrasonography diagnosis

Diagnostic mode	Diagnostic sensitivity	Diagnostic specificity	Diagnostic accuracy
Two-dimensional ultrasonography examination	64.56% (51/79)	76.47% (26/34)	68.14% (77/113)
Three-dimensional ultrasonography examination	92.41% (73/79)	88.24% (30/34)	91.15% (103/113)
χ^2	18.139	1.619	18.451
P value	0.000	0.203	0.000

Table 4 Analysis of different types of central nervous system malformations detected by two-dimensional and three-dimensional ultrasonography

Diagnostic mode	Brain perforation malformation	Abnormality of corpus callosum	Meningoencephalocele	Choroidal cyst	Exposed brain malformation	Galen venous hemangioma	Arachnoid cyst	Spina bifida	Hydrocephalus
Two-dimensional ultrasonography examination	50.00% (2/4)	50.00% (2/4)	60.00% (3/5)	57.14% (4/7)	77.78% (7/9)	72.73% (8/11)	58.33% (7/12)	61.54% (8/13)	71.43% (10/14)
Three-dimensional ultrasonography examination	100.00% (4/4)	75.00% (3/4)	100.00% (5/5)	85.71% (6/7)	88.89% (8/9)	100.00% (11/11)	91.67% (11/12)	92.31% (12/13)	92.86% (13/14)
χ^2	2.667	0.533	2.500	1.400	0.400	3.474	3.556	3.467	2.191
P value	0.102	0.465	0.114	0.237	0.527	0.062	0.059	0.063	0.139

The function of ultrasonic diagnostic instruments has made a breakthrough with the development of science and technology. Three-dimensional ultrasonography can stereoscopically and dynamically present the morphological structure of the fetal CNS followed by three-dimensional reconstruction by computer post-processing. Examination of the fetus at any angle and orientation is convenient to directly reflect the details of the fetal CNS and the spatial relationship with adjacent structures[16]. In this study, it was found that the image quality of three-dimensional ultrasonography

was better than that of two-dimensional ultrasonography after examination of fetal CNS malformations by two-dimensional ultrasonography and three-dimensional ultrasonography. In addition, the sensitivity and accuracy of three-dimensional ultrasonography in the diagnosis of fetal CNS malformations were higher than those of two-dimensional ultrasonography. This indicates that three-dimensional ultrasonography is more valuable in the diagnosis of fetal CNS malformations, which can effectively improve the sensitivity and accuracy of diagnosis, reduce the risk of missed diagnosis or misdiagnosis, and avoid the burden on pregnant women's families and society.

The main justification for this analysis is that conventional two-dimensional ultrasonography has low visibility of brain tissue around the probe, it is difficult to find brain parenchyma micropathological changes, and it is impossible to accurately evaluate the degree and cause of malformations such as fetal hydrocephalus. Three-dimensional ultrasonography can simultaneously present multiple standard sections of the fetal CNS on the screen, comprehensively explore the intracranial structure, and quickly determine whether there are structural abnormalities. In addition, the superimposed image quality of multilayer sections in three-dimensional ultrasonography examination is higher and can clearly display the section details and avoid the blurring of part of the structure of the traditional two-dimensional ultrasonography section. In addition, three-dimensional ultrasonography can provide hemodynamic information of the CNS, allows adjustment of the entry angle of the probe before the start of scanning, and clearly shows the blood flow signal of the area of interest[17]. However, this study found that three-dimensional ultrasonography examination of fetal CNS malformations also resulted in missed diagnosis, indicating that although three-dimensional ultrasonography alone has high application value, there is still a certain risk of missed diagnosis. As a consequence, clinical practice can refer to specific conditions combined with other examinations for a comprehensive diagnosis. Meoded *et al*[18] also pointed out that three-dimensional ultrasonography can stereoscopically and dynamically show the morphological structure of the fetal CNS, carry out three-dimensional reconstruction, perform multiangle and omnidirectional observations, and visually view the details of the fetal CNS. However, it aimed to address craniocerebral tumors and abnormalities of the corpus callosum, and a definite diagnosis can be made only when the gestational age is higher. Hence, it can be combined with other means for comprehensive diagnosis or close observation at different gestational weeks, which is consistent with the point of view of this study.

CONCLUSION

Generally, three-dimensional ultrasonography has high application value in the diagnosis of fetal CNS malformations, with clear image quality and a high sensitivity and accuracy.

ARTICLE HIGHLIGHTS

Research background

Birth defects are abnormalities in the fetal body structure and function that occur in the uterus before delivery.

Research motivation

It is necessary to diagnose birth defects as efficiently and accurately as possible.

Research objectives

This study aimed to determine the application value of ultrasonography examination.

Research methods

One hundred and thirteen pregnant women suspected of having fetal central nervous system (CNS) malformations at our hospital from December 2018 to October 2020 were examined using two-dimensional ultrasonography and three-dimensional ultrasonography, respectively.

Research results

The diagnostic sensitivity (92.41%) and accuracy (91.15%) of three-dimensional ultrasonography were higher than those of two-dimensional ultrasonography (64.56% and 68.14%, respectively).

Research conclusions

Three-dimensional ultrasonography has high application value in the diagnosis of fetal CNS malformations.

Research perspectives

Screening of birth defects is important in the clinic.

REFERENCES

1 **Zhang N**, Dong H, Wang P, Wang Z, Wang Y, Guo Z. The Value of Obstetric Ultrasound in Screening Fetal Nervous System Malformation. *World Neurosurg* 2020; **138**: 645-653 [PMID: 31931232 DOI: 10.1016/j.wneu.2020.01.014]

2 **Yates JF**, Troester MM, Ingram DG. Sleep in Children with Congenital Malformations of the Central Nervous System. *Curr Neurol Neurosci Rep* 2018; **18**: 38 [PMID: 29789951 DOI: 10.1007/s11910-018-0850-6]

3 **Kingdom JC**, Audette MC, Hobson SR, Windrim RC, Morgen E. A placenta clinic approach to the diagnosis and management of fetal growth restriction. *Am J Obstet Gynecol* 2018; **218**: S803-S817 [PMID: 29254754 DOI: 10.1016/j.ajog.2017.11.575]

4 **Ge MM**, Gao YY, Wu BB, Yan K, Qin Q, Wang H, Zhou W, Yang L. Relationship between phenotype and genotype of 102 Chinese newborns with Prader-Willi syndrome. *Mol Biol Rep* 2019; **46**: 4717-4724 [PMID: 31270759 DOI: 10.1007/s11033-019-04916-2]

5 **Xie JX**, You JH, Chen XK, Su YM, Liu JR, Su SS, Hou M, Lv GR. Three-dimensional sonographic minute structure analysis of fetal cerebellar vermis development and malformations: utilizing volume contrast imaging. *J Med Ultrason (2001)* 2019; **46**: 113-122 [PMID: 30291575 DOI: 10.1007/s10396-018-0906-x]

6 **Martins Santana EF**, Araujo Júnior E, Tonni G, Costa FDS, Meagher S. Acrania-exencephaly-anencephaly sequence phenotypic characterization using two- and three-dimensional ultrasound between 11 and 13 wk and 6 days of gestation. *J Ultrason* 2018; **18**: 240-246 [PMID: 30451407 DOI: 10.15557/JoU.2018.0035]

7 **Jauniaux E**, Prefumo F. Prenatal diagnosis of fetal anomalies from the third to the first trimester and back. *BJOG* 2021; **128**: 271 [PMID: 33063913 DOI: 10.1111/1471-0528.16523]

8 **Maya-Enero S**, Candel-Pau J, Rebollo-Polo M, Candela-Cantó S, de la Torre R, López-Vílchez MÁ. Central nervous system malformation associated with methamphetamine abuse during pregnancy. *Clin Toxicol (Phila)* 2018; **56**: 795-797 [PMID: 29343133 DOI: 10.1080/15563650.2018.1428338]

9 **Shrot S**, Soares BP, Whitehead MT. Cerebral Diffusivity Changes in Fetuses with Chiari II Malformation. *Fetal Diagn Ther* 2019; **45**: 268-274 [PMID: 30121678 DOI: 10.1159/000490102]

10 **Torky HA**, Moussa AA, Ahmad AM, Dief O, Eldesoouky MA, El-Gayed AS. Three-dimensional ultrasound first trimester fetal volume measurement and its relation to pregnancy outcome. *J Perinat Med* 2017; **45**: 1039-1044 [PMID: 28063263 DOI: 10.1515/jpm-2016-0315]

11 **Shah H**, Al-Memar M, de Bakker B, Fourie H, Lees C, Bourne T. The first-trimester fetal central nervous system: a novel ultrasonographic perspective. *Am J Obstet Gynecol* 2017; **217**: 220-221 [PMID: 28578173 DOI: 10.1016/j.ajog.2017.05.053]

12 **Oi S**, Matsumoto S, Katayama K, Mochizuki M. [New clinical phase in intrauterine diagnosis and therapeutic modalities of CNS anomalies]. *No Shinkei Geka* 1989; **17**: 1029-1035 [PMID: 2687709]

13 **Rasmussen CK**, Hansen ES, Ernst E, Dueholm M. Two- and three-dimensional transvaginal ultrasonography for diagnosis of adenomyosis of the inner myometrium. *Reprod Biomed Online* 2019; **38**: 750-760 [PMID: 30792048 DOI: 10.1016/j.rbmo.2018.12.033]

14 **Society for Maternal-Fetal Medicine (SMFM)**; Fox NS, Monteagudo A, Kuller JA, Craigo S, Norton ME. Mild fetal ventriculomegaly: diagnosis, evaluation, and management. *Am J Obstet Gynecol* 2018; **219**: B2-B9 [PMID: 29705191 DOI: 10.1016/j.ajog.2018.04.039]

15 **Manganaro L**, Bernardo S, Antonelli A, Vinci V, Saldari M, Catalano C. Fetal MRI of the central nervous system: State-of-the-art. *Eur J Radiol* 2017; **93**: 273-283 [PMID: 28668426 DOI: 10.1016/j.ejrad.2017.06.004]

16 **Martinez-Ten P**, Illescas T, Adiego B, Estevez M, Bermejo C, Wong AE, Sepulveda W. Non-visualization of choroid plexus of fourth ventricle as first-trimester predictor of posterior fossa anomalies and chromosomal defects. *Ultrasound Obstet Gynecol* 2018; **51**: 199-207 [PMID: 28236314 DOI: 10.1002/uog.17445]

17 **Domröse CM**, Bremer S, Buczek C, Geipel A, Berg C, Hellmund A, Gembruch U, Willruth A. Termination of pregnancy following prenatally diagnosed central nervous system malformations. *Arch Gynecol Obstet* 2018; **298**: 903-910 [PMID: 30218186 DOI: 10.1007/s00404-018-4900-8]

18 **Meoded A**, Huisman TAGM. Diffusion Tensor Imaging of Brain Malformations: Exploring the

Internal Architecture. *Neuroimaging Clin N Am* 2019; **29**: 423-434 [PMID: 31256863 DOI: 10.1016/j.nic.2019.03.004]

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