Int J Clin Exp Med 2020;13(4):2520-2526
www.ijcem.com /ISSN:1940-5901/IJCEM0102701

Original Article

The congenital malformation detection rate and the maternal satisfaction rate are improved using fetal systemic ultrasonography

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Received September 23, 2019; Accepted January 8, 2020; Epub April 15, 2020; Published April 30, 2020

Abstract: Objective: To determine whether the congenital malformation detection rate and the maternal satisfaction rate are improved using fetal systemic ultrasonography. Methods: A total of 240 pregnant women who underwent prenatal examinations in the Department of Gynecology and Obstetrics of Jingzhou Hospital from September 2016 to September 2017 were selected as subjects. All the subjects underwent fetal systemic ultrasonography or a routine obstetric examination. The results of the two groups were compared. Results: The sensitivity, specificity, and diagnostic coincidence rate of the routine obstetric ultrasound for the clinical diagnosis of fetal congenital malformation were 53.33%, 53.81%, and 53.75%, respectively. The sensitivity, specificity, and diagnostic coincidence rate of the fetal systemic ultrasound for the clinical diagnosis of fetal congenital malformation were 90.00%, 84.76%, and 86.67%, respectively. The sensitivity, specificity, and diagnostic coincidence rate of the fetal systemic ultrasound for the clinical diagnosis of fetal cardiac tumors were higher than those of the routine obstetric ultrasound. Apart from the specificity, there were statistically significant differences between the sensitivity and the diagnostic coincidence rate ($P < 0.05$). The maternal satisfaction rate, the general satisfaction, and the total satisfaction rate with the fetal systemic ultrasound were higher than the satisfaction rates of those undergoing only routine obstetric ultrasound, and the difference was statistically significant ($P < 0.001$). Conclusion: Routine ultrasound diagnosis and fetal systemic ultrasound diagnosis are used to observe fetal congenital malformation in early pregnancy. The sensitivity, specificity, and diagnostic coincidence rates of fetal systemic ultrasound diagnosis for fetal congenital malformation are significantly higher than those of conventional ultrasound diagnosis. Fetal systemic ultrasound diagnosis has important clinical value in providing an accurate reference for clinicians and improving the quality of the new-born population.

Keywords: Fetal systemic ultrasonography, conventional ultrasound, fetal congenital malformation, maternal satisfaction rate

Introduction

A congenital malformation is a type of congenital birth defect. Tissue structure loss and chromosomal abnormality in the maternal uterus are the direct causes of congenital malformations [1-3]. With the continuous development of the social economy, the living environment is constantly changing, and the life pressure of women is also increasing. In addition, unhealthy diet and bad habits also have led to an increase in the global neonatal malformation rate [2, 4-6]. After a child with birth defects is born, death can easily occur in his infancy or early childhood. Congenital malformations are not only the main cause of perinatal death, but they also have a great impact on fetal development and on the family [7, 8]. In order to reduce the burden on families and society, the timely detection of severe fetal malformations and the induction of labor to reduce the birth rate with congenital malformations and improve the newborns' quality are the top priorities of current antenatal care [9-11].

Ultrasonography is a routine method for screening congenital malformations during pregnancy. Ultrasonography in obstetrics and gynecology can help doctors fully understand pregnant women, and the figure, structure and important organs of their fetuses. It can indicate bad maternal and neonatal outcomes and indicate whether the pregnancy can be continued [12-15]. With the development and innovation of

Table 1. Clinical data of the 240 pregnant women [n (%)]

Group	[n (%)]
Age	
≤26	100 (41.67)
>26	140 (58.33)
Body weight (kg)	
≤54	80 (33.33)
>54	160 (66.67)
History of smoking	
Yes	40 (16.67)
no	200 (83.33)
History of radiation exposure	
Have	10 (4.17)
no	230 (95.83)
Fetal chromosomal abnormalities	
Have	30 (12.50)
no	210 (87.50)
Fasting blood glucose	
≤5.6 mmol/L	240 (100.00)
>5.6 mmol/L	0 (0.00)
Blood type	
A	80 (33.33)
B	50 (20.83)
AB	42 (17.50)
O	68 (28.33)
Fetal malformation	
Hydrocephalus	9 (1.25)
Brainless	2 (0.83)
Visceral eversion	10 (4.17)
Cerebellar sacral loss	9 (1.25)

medical diagnostic techniques in recent years, ultrasonography has been constantly improved, as has fetal systemic ultrasonography [16-18]. Fetal systemic ultrasonography involves midtrimester pregnancy, late pregnancy, and targeted ultrasonography, which is more careful and comprehensive than conventional obstetric ultrasound [19]. In order to investigate the application value of fetal systemic ultrasonography on the fetal congenital malformation diagnosis, this study analyzed how the congenital malformation detection rate and the maternal satisfaction rate are improved by fetal systemic ultrasonography.

Materials and methods

Clinical data

A total of 240 pregnant women who underwent prenatal examination in the Department of Gynecology and Obstetrics of Jingzhou Hospital from September 2016 to September 2017 were selected as subjects. They ranged from 23 to 38 years old, with an average age of (26.1±2.8) years old. The gestational ages ranged from 24-39 weeks, and the average gestational age was (30.6±5.4) weeks. Finally, there were 30 cases of congenital malformations confirmed by the induction of labor, delivery, and autopsy (**Table 1**).

Inclusion and exclusion criteria: only pregnant women admitted to the Department of Obstetrics of Jingzhou Hospital were included in the study. All of the subjects were examined and diagnosed based on congenital malformation specified descriptions [20]. The subjects should not have complications during pregnancy. Patients with hypertension, hepatitis B virus, gallstones, AIDS, or various blood diseases were excluded; factors such as intrauterine malposition, asymmetry of the head and pelvis, and pelvis interval stenosis were excluded. The study was approved by the hospital ethics committee, and all the subjects and their families signed the informed consent before the study began.

Instruments and methods

Instruments: SONOACEX7 ultrasound apparatus (Wuhan East Medical Instrument Co., Ltd.), BLS-X8 color Doppler ultrasound apparatus (Xuzhou Belse Electronic Technology Co., Ltd.).

All the subjects underwent fetal systemic ultrasonography and conventional obstetric ultrasonography.

a. Conventional obstetric ultrasonography includes determining the location of the fetus, the fetal heart and placenta; the maximum depth of the amniotic fluid and the placenta classification. b. Fetal systemic ultrasonography includes mapping the cross sections and conventional ultrasound systemic contents of all the system organizations. The examination lasts for about 30 minutes. The specific operation requirements require that all the women lie on their sides and in a supine position. The ultrasound probe needs to be in parallel with the fetal spine according to the fetal position. After the heart four-chamber view appears, the probe is rotated by 90 degrees to observe whether the fetal myocardial thickness, aorta, and pulmonary artery structure are normal, whether the left atrium is symmetrical with the right one, and whether the left ventricle is sym-

Table 2. Results of the clinical diagnosis of congenital malformations using fetal obstetric ultrasound

Group	Postpartum diagnosis of congenital malformation	Postpartum diagnosis of non-congenital malformations	Total
Routine obstetric ultrasound is diagnosed as congenital malformation	16	97	113
Routine obstetric ultrasound is diagnosed as a non-congenital malformation	14	113	127
Total	30	210	240

Table 3. Results of the clinical diagnosis of fetal systemic congenital malformation using fetal system ultrasonography

Group	Postpartum diagnosis of congenital malformation	Postpartum diagnosis of non-congenital malformations	Total
Fetal system ultrasound confirmed congenital malformation	27	32	59
Fetal system ultrasound confirmed as non-congenital malformation	3	178	181
total	30	210	240

Table 4. A comparison of the values of the two ultrasound examinations in the clinical diagnosis of fetal congenital malformations

Group	Conventional obstetric ultrasound	Fetal system ultrasound	X^2	t
Sensitivity	53.33% (16/30)	90.00% (27/30)	9.932	0.002
Specificity	53.81% (113/210)	84.76% (178/210)	47.270	<0.001
Diagnostic coincidence rate	53.75% (129/240)	86.67% (205/240)	56.86	<0.001

metrical with the right one. The physicians observed various organs and tissue structures through the different sections. If abnormalities of the sonogram occurred, the BLS-X8 color Doppler ultrasound apparatus was used for the examination. All the diagnoses were completed by 10 senior physicians in the Imaging Department.

Outcome measures: The sensitivity, specificity and diagnostic coincidence rate of the two types of ultrasonography were calculated. The maternal satisfaction of the two types of ultrasonography was compared.

Statistical methods: A statistical analysis of data was completed using SPSS 17.0 (Yiyun (Shanghai) Information Technology Co., Ltd.) software. The enumeration data were indicated as a percentage [n (%)]. The differences between the two techniques were compared using x^2 tests. $P < 0.05$ indicated statistical significance.

Results

General clinical data

The general clinical data of the pregnant women are shown in **Table 1**.

A comparison of the clinical diagnosis value of the two types of ultrasonography for fetal congenital malformations

The sensitivity, specificity, and diagnostic coincidence rates of the routine obstetric ultrasound for the clinical diagnosis of fetal congenital malformation were 53.33%, 53.81%, and 53.75%, respectively. The sensitivity, specificity, and diagnostic coincidence rates of the fetal systemic ultrasound for the clinical diagnosis of fetal congenital malformation were 90.00%, 84.76%, and 86.67%, respectively. The sensitivity, specificity, and diagnostic coincidence rates of fetal systemic ultrasound for the clinical diagnosis of fetal cardiac tumors were higher than those of the conventional obstetric ultrasound. Apart from the specificity, there statistically significant differences in the sensitivity and diagnostic coincidence rates ($P < 0.05$) (**Tables 2**-**4** and **Figure 1**).

Comparison of the maternal nursing satisfaction

The maternal nursing satisfaction, the general satisfaction, and the total nursing satisfaction with the fetal systemic ultrasound were higher than they were with the routine obstetric ultra-

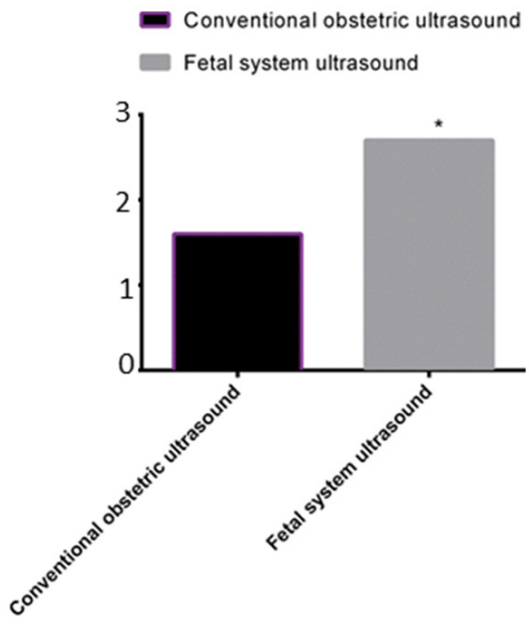

Figure 1. A comparison of the clinical diagnostic values of the two types of ultrasonography for fetal congenital malformations. *The number of fetal congenital malformations detected by fetal systemic ultrasound was higher than the number detected by conventional ultrasound, and the difference was statistically significant ($P < 0.001$).

sound, and the differences were statistically significant ($P < 0.001$); (**Table 5** and **Figure 2**).

Discussions

For ultrasonography during pregnancy, the relevant medical staff can determine fetal deformities by monitoring the fetal umbilical artery blood flow, the single umbilical artery, and any amniotic fluid volume abnormalities. Once a severe congenital malformation is observed during the screening, the pregnant women and their families can choose to terminate the pregnancy, thereby reducing the birth rate of congenital malformed fetuses and improving the quality of the newborns [21, 22]. Therefore, ultrasound diagnosis has a great influence on fetal pregnancy outcomes and on neonatal prognosis.

In this study, both routine obstetric ultrasonography and fetal systemic ultrasonography was conducted. The clinical diagnostic value of conventional obstetric ultrasonography and fetal systemic ultrasonography for fetal congenital malformation was compared. At the early stage of pregnancy, fetal malformations are difficult to detect due to frequent fetal movements and the small abnormal fetal heart [23]; during late pregnancy, the diagnostic accuracy of ultrasonography is easily affected by the decrease in amniotic fluid volume, the fixed fetal position, and the acoustic shadows of the ribs and spine [24]. Conventional ultrasonography is not equipped with an advanced image device. In addition, it is often focused on the position of the fetus, the fetal heart, and the placenta [25]. The fetal systemic ultrasound examination not only includes all the elements of conventional ultrasonography, but it also screens the cross-sections of various system tissues and the overall development of the fetus more comprehensively [26]. Through the data analysis of this study, the sensitivity, specificity, and diagnostic coincidence rates of the routine obstetric ultrasound for the clinical diagnosis of fetal congenital malformation were 53.33%, 53.81%, and 53.75%, respectively. The sensitivity, specificity, and diagnostic coincidence rates of the fetal systemic ultrasound for the clinical diagnosis of fetal congenital malformation were 90.00%, 84.76%, and 86.67%, respectively. The sensitivity, specificity, and diagnostic coincidence rates of the fetal systemic ultrasound for the clinical diagnosis of fetal cardiac tumors were higher than they were for routine obstetric ultrasound. Apart from the specificity, there were statistically significant differences in the sensitivity and diagnostic coincidence rates. Related studies show that fetus needs to be monitored by fetal systemic ultrasound in real-time. Compared with the previous two-dimensional ultrasound instruments, ultrasonic detection instruments with a higher resolution are required. The experience requirements for relevant operators are also increased, and in order to reduce or avoid missed diagnosis, the operator is required to perform multiple-section, multi-angle, and comprehensive observations during the examination to improve the detection rate of fetal malformations [27-30]. In recent years, related reports showed that there were studies on the application of fetal systemic ultrasonography to fetal congenital malformations. The results shows that fetal systemic ultrasound examination has a very low rate of missed diagnosis in congenital fetal malformations. What's more, it has a high diagnostic coincidence rate in different fetal malformation types [3]. This is consistent with the research viewpoint of this paper. It is an excel-

Table 5. A comparison of the satisfaction rates between the two groups [n (%)]

Group	n	Satisfaction	General	Dissatisfied	Total satisfaction rate
Routine obstetric ultrasound	240	40 (16.67)	80 (33.33)	120 (50.00)	120 (50.00%)
Fetal system ultrasound	240	100 (41.67)	116 (48.33)	24 (10.00)	216 (90.00%)
X^2		-	-	-	91.430
P		-	-	-	<0.001

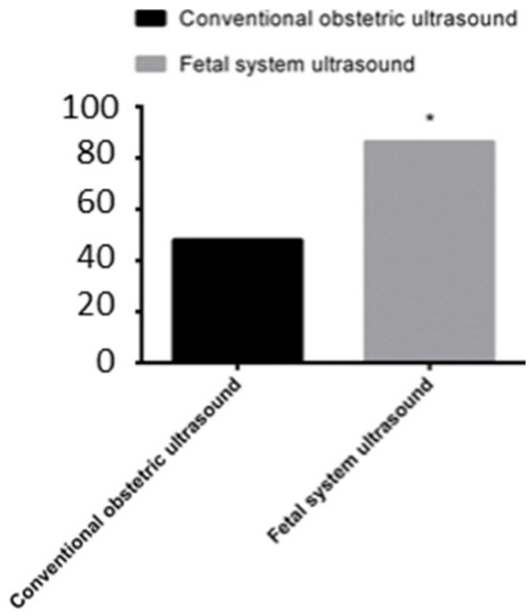

Figure 2. Comparison of the maternal satisfaction rate between the two groups. *indicates that maternal satisfaction rate with fetal systemic ultrasound was higher than it was with routine obstetric ultrasound, and the difference was statistically significant ($P < 0.001$).

lent supplement to the research results of this paper. Finally, the nursing satisfaction with fetal ultrasound screening was determined among all the maternal women. Through the statistical results, the maternal nursing satisfaction, the general satisfaction, and the total nursing satisfaction with fetal systemic ultrasound were higher than they were with routine obstetric ultrasound, and the differences were statistically significant. At this stage, prenatal ultrasonography has been accepted by most pregnant women and their families. It has become a common clinical screening program. The continuous development and improvement of fetal systemic ultrasound examinations can improve the detection rate of fetal malformations. At the same time, it is important to the pregnant women, their families, and even the quality of the newborns. It is worthy of continuous clinical promotion [31, 32].

In this experiment, as the subjects are affected by the different regional environments and the overall level of local medical treatment, the prognosis of the patients will be different. It may lead to the contingency of the experimental results; the subjects will be tracked for a longer period. The number of research subjects will be expanded to achieve the best statistical results.

In summary, routine ultrasound diagnosis and fetal systemic ultrasound diagnosis are used to observe fetal congenital malformations in early pregnancy. The sensitivity, specificity, and diagnostic coincidence rates of fetal systemic ultrasound diagnosis for fetal congenital malformation are significantly higher than they are with conventional ultrasound diagnosis. It has an important clinical value in providing an accurate reference for clinicians and improving the quality of the newborn population.

Disclosure of conflict of interest

None.

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