Diagnostic value of standardized ultrasonography during early pregnancy in fetal malformation screening.

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Abstract

Objective: To investigate the diagnostic value of standardized ultrasonography during early pregnancy in fetal malformation screening.

Methods: From July 2015 to July 2017, 2534 pregnant women enrolled in our hospital to receive fetal malformation screening during early pregnancy were selected as the objects. All pregnant were given standardized ultrasonography at 11~13+6 w of gestation to acquire the information of baby's Crown Rump Length (CRL), Nuchal Translucency (NT), fetal abnormalities and chromosomal abnormalities. The effect of ultrasound was analysed by comparing its result with the result of induction delivery.

Results: In these 2534 pregnant women, 25 cases of fetal malformation were detected by standardized ultrasonography during early pregnancy with the diagnostic accuracy rate highly reaching 96%. CRL and NT of the parturient women at 13-13+6 w of gestation were significantly higher than those of the pregnant at 12-13+6 w and 11-12+6 w of gestation; The CRL and NT of the parturient women at 12-13+6 w of gestation were obviously higher than those of the women at 11-12+6 w of gestation and the difference had statistical significance (P<0.05). The ultrasound examination result showed that in these 2534 pregnant women 33 cases were fetal NT thickening. NT thickening of 3.0-4.9 mm was found in 20 cases in which there were 2 cases of induction delivery and 18 cases of normal postpartum. NT thickening of 5.0-6.0 mm was seen in 7 cases in which there were 4 cases of chromosome abnormalities, 4 cases of induction delivery and 3 cases of normal postpartum. NT thickening beyond 6.0 mm was observed in 6 cases in which there were 6 cases of induction delivery with no normal postpartum. The fetal normal rate after delivery of the women with NT thickening beyond 6.0 mm was significantly lower than that of those with NT thickening of 5.0-6.0 mm and NT thickening of 3.0-4.9 mm of statistical significance (P<0.05).

Conclusion: Standardized ultrasonography in early pregnancy has good effects in fetal malformation screening.

Introduction

Fetal malformation, the structural or chromosome abnormalities occurring in the uterus, is a serious complication seen in obstetrical department. The current treatment method turns out to strengthen the early diagnosis of fetal malformation and performs labor induction in a timely manner. At present, the period of "11-14 w of gestation" is the first choice for the examination of fetal malformation. In that period, the structure of fetal organs has basically formed and many reports showed that serious deformity of fetal limbs can be detected 12 w before the pregnancy and NT can be effectively measured for diagnosis of fetal abnormalities [1]. With the above background, 2534 pregnant women enrolled in our hospital from July 2015 to July 2017 and receiving fetal malformation screening during early pregnancy were given standardized ultrasonography at 11~13+6 w of gestation followed by the summary of test results. The following is the retrospective analysis of specific diagnosis and follow-up performance.

Material and Methods

General materials

2534 pregnant women enrolled in our hospital from July 2015 to July 2017 and receiving fetal malformation screening during early pregnancy were selected as the objects. Inclusion criteria:

singleton pregnancy; the pregnant with the consent from the Hospital Ethics Association and voluntary participation in the diagnostic study. Exclusive criteria: pregnant women with serious diseases of heart, lung, kidney, stomach or other important organs; pregnant women with ultrasound examination contraindication, pregnant women with difficulty in cooperating with the study. The selected pregnant women were 20-45 y old with an average age of 29.7 (s=7.5), including 542 cases at 11-12+6 w of gestation, 1041 cases at 12-13+6 w of gestation and 951 cases at 13-13+6 w of gestation.

Methods

All pregnant women were given standard ultrasound examination in early pregnancy at 11-13+6 w of gestation through Voluson E8 color Doppler ultrasound diagnostic instrument of 3.0-5.0MHz in probe frequency produced by American GE company. The cases were treated with routine abdominal examination. The fetal midline sagittal section was inspected at first to display the fetal nasal bone. The image was appropriately amplified to determine venous blood flow, CRL and NT value followed by the probe's rotation of 90° for inspection of cross section, which can be conducted from head to foot of the baby and the probe, could rotate in this process for detection of multi section on the fetus. An examination of the fetal craniofacial region should involve the detection of skull ring, midline and lateral ventricle, brain parenchyma and choroid plexus followed by the observation on fetal eyes, the eyeball shape, jaw bones, nasal bones and facial triangle; In cause of monitoring the fetal neck, NT value was required to be measured and status of fetal neck mass as well as cord around neck needed to be acquired. In the monitor of fetal chest, the fetal heart should be probed to make clear the cardiothoracic ratio and the status of the apex. The women at 13 w of gestation were followed up to figure out the condition of fetus atrioventricular, large artery, ductal and aortic arches and lung echo; During the inspection of abdomen, it was need to understand the status of abdominal wall and notice whether the apex was directed in the same direction as the gastric bubble. Besides it was also required to understand the spectrum for fetal ductus venosus and the tendency of intravenous catheter in the median sagittal plane followed by comprehension of such items as organs migrate in vertical plane, diaphragmatic defect and status of umbilical artery during transection of bladder. The limbs structure of the baby was examined to figure out the condition of trunk angulation, limb length and the shape and mobility of the joint in flexed position [2,3].

Observation index

Statistical analysis was conducted on the result of fetal anomaly screening in early pregnancy.

Statistical analysis was conducted on CRL and NT status at different pregnancy duration.

Statistical analysis was conducted on NT thickening status and the pregnant women with NT thickening were followed up with chromosome tracking and given ultrasound examination in the middle or late pregnancy according to the reality. If the fetus malformation was moderately serious, the induction of labor was likely to be performed after being agreed by the parturient and their family members with its pathological examination result as the gold standard [4].

Statistical methods

SPSS19.0 software was used for data processing and analysis, and the results of CRL and NT detection were expressed by "mean ± standard deviation" and checked by T test. NT thickening and postpartum outcome were described as "percentage" and tested by χ^2, P<0.05 suggested the difference had statistical significance.

Results

Results of fetal malformation screening in early pregnancy

2534 pregnant women underwent standardized ultrasonography in early pregnancy and 25 cases of fetal malformation were detected. The monitoring result tallied with that of the induction delivery except for 1 case of cardiac abnormality. The diagnostic accuracy of standardized ultrasonography in early pregnancy amounted to 96%. The specific results of fetal malformation examination were shown in Table 1 below.

Table 1. *Analysis of fetal malformation screening in early pregnancy.*

	Anencephalies	Scoliosis	Dysmelia	Hygroma colli	Anasarca	Pcromphalus	Cardiac abnormality	Sum
Case	2	4	2	5	7	3	2	25
Rate	8.0	16.0	8.0	20.0	28.0	12.0	8.0	100.0

Analysis of CRL and NT examination in different pregnancy duration

CRL and NT of the parturient women at 13-13+6 w of gestation were significantly higher than those of the pregnant

at 12-13+6 w (t=3.927, 12.461) and 11-12+6 w (t=8.522, 19.375) of gestation of statistical significance (P<0.05).

The CRL and NT of the parturient women at 12-13+6 w of gestation were obviously higher than those of the women at

11-12+6 w of gestation and the difference had statistical significance, t=62.689, 10.964 (P<0.05) (Table 2).

Table 2. Analysis of CRL and NT examination in different pregnancy duration.

Gestational weeks	Case	CRL (mm)	t value	P value	NT (mm)	t	P
11-12+6	542	52.18 ± 3.54	8.522	0.001	1.26 ± 0.15	3.873	0.018
12-13+6	1041	64.11 ± 3.62	3.927	0.017	1.51 ± 0.22	3.162	0.034
13-13+6	951	76.59 ± 3.92	--	--	1.77 ± 0.11	--	--

Analysis on follow-up results of NT thickening in parturient woman

33 from these 2534 pregnant women were seen to have fetal NT thickening. NT thickening of 3.0-4.9 mm was found in 20 cases, NT thickening of 5.0-6.0 mm in 7 cases and NT thickening>6.0 mm in 6 cases. The fetal normal rate after delivery of the women with NT thickening>6.0 mm was significantly lower than that of those with NT thickening of 5.0-6.0 mm and NT thickening of 3.0-4.9 mm of statistical significance (P<0.05) (χ^2=6.667, p=0.010; χ^2=17.550, p=0.000). There was no significant difference in the fetal normal rate between the cases of NT thickening>6.0 mm and those with NT thickening of 5.0-6.0 mm (χ^2=3.343, p=0.067) (Table 3).

Table 3. Analysis on follow-up results of NT thickening in parturient woman.

NT thickening (mm)	Case	Sonographic anomalies	Chromosome examination	Induction delivery	Normal fetus after delivery	Fetal normal rate (%)
3.0-4.9	20	2 cases (anasarca 1, fetal death 1)	unimplemented	2 (induction of labor in early pregnancy)	18	90.0
5.0-6.0	7	3 (18-trisome 1, 21-trisome 2)	418-trisome trisome 2 2,21-	4 (induction of labor during second trimester)	3	42.9
>6.0	6	6 (hygroma colli 5, anasarca1)	unimplemented	6 (induction of labor in early pregnancy)	0	0.0

Discussion

Fetal malformation is one of serious obstetric complications in clinical practices and according to clinical studies results from complicated factors including maternal factors, external environment and transmissibility [5]. At present, the incidence of fetal malformation is approximately 3% of that of live-born infant and it seriously affects the therapy on and life safety of the new-born, posing a great burden to both the family and society. What's worse, fetal malformation, when serious, may lead to severe disability or even death and currently it has become an important cause of children death [6-8]. The key to giving a good birth and good care becomes to strengthen the early diagnosis and treatment of fetal malformation.

In the previous pregnancy test during early pregnancy, more attention was paid to the examination on location of gestational sac, gestational age and pregnancy quantity with less diagnosis of related complications like fetal malformation [9]. The continuous progress of medical technology has made for a significant development of imaging technique in which ultrasound imaging is commonly used with simple operation, non-invasiveness and low requirement of maternal tolerance; And with the evolution of ultrasound technology, the resolution of ultrasonic diagnosis and the image quality are gradually enhanced, significantly improving the diagnostic effects [10-12]. There are many types of fetal malformation and with immature foetation during the early pregnancy, the ultrasound in this period can detect symptoms of fetal textural anomaly, commonly including serious abnormality of cardiac structure, severe neurologic abnormality, facial abnormality and abnormal limb development as well as sciatic development [13-15]. In this study, the diagnostic accuracy of ultrasound for fetal malformation was 96%, indicating that the implementation of standardized ultrasound in early pregnancy has remarkable effects on the diagnosis of fetal malformation. NT refers to the thickness of the fluid accumulation within the subcutaneous tissue of fetal regio colli posterior and many clinical research results show that the best time for the diagnosis of NT is 11-13+6 w of gestation and NT will show a downward trend when the gestational week is more than 14 and the detection effect would be also reduced [16-18]. In this study, the NT level of pregnant women at 11-13+6 w of gestation increased gradually with the rising of gestational week and the higher the degree of NT thickening, the worse the fetal malformation and delivery outcome. In this research, 4 chromosomal abnormal fetuses were all with the NT thickening of 5.0-6.0 mm and 6 cases of NT thickening>6.0 mm were given no chromosome examination, suggesting that the rising degree of NT thickening will increase the risk of chromosome abnormality. For this reason, it is required to detect NT without delay in early pregnancy to timely

understand the risk of chromosomal abnormality and assess fetal development status [19,20].

To sum up, standardized ultrasonography during early pregnancy has good performance in fetal malformation screening. It can detect the malformation and conduct induction of labor in time, reducing the trauma of pregnant women both physiologically and psychologically. It is, therefore, of high application value in clinical trials.

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