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Value of First and Early Second Trimester Fetal Echocardiography and Fetal Nuchal Translucency Measurement in Prediction of Fetal Congenital Heart Diseases

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Congenital heart anomalies have a significant effect on affected children's life with up to 25:35% mortality rate during pregnancy and the postnatal period, and 60% of this mortality occurs during the first year of life.
Objectives: To evaluate the value of fetal echocardiography and measuring of fetal nuchal translucency thickness in first and early second trimester in prediction of fetal congenital heart disease.
Methods: A prospective observational cohort study was conducted on 200 pregnant women attended to Tanta University Hospital, Department of Obstetrics and Gynecology at outpatient clinic or inpatient, the study took from January 2019 to December 2020. Patients underwent transabdominal fetal echocardiography at 10:16 weeks of gestation. transvaginal scan was also performed when needed. The first step in fetal cardiac ultrasound is to evaluate the orientation of the fetal laterality (presentation and lie). Establishing situs and atrial arrangement, Five short-axis views of heart. First view is acquired in abdomen at level of stomach to identify situs.
Results: predict congenital heart disease (compared to results of first Echo), nuchal translucency had 83.33% sensitivity, 98.97% specificity, 71.43% PPV, 98.50% NPV and 99.48% accuracy..

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predict congenital heart disease (compared to fetal outcome), nuchal translucency had 83.33% sensitivity,98.97% specificity, 71.43% PPV, 99.48%% NPV and 98.50% accuracy.
Conclusions: Fetal echocardiography and measuring of fetal nuchal translucency thickness in first and early second trimester have good sensitivity in prediction and better specificity in exclusion of fetal congenital heart diseases.

Keywords: Trimester fetal; echocardiography; fetal nuchal translucency; congenital heart diseases.

1. INTRODUCTION

Major CHD are the most common severe congenital malformations, with an incidence of 5 /1000 live births. Although CHD used to appear isolated, they are frequently associated with other defects, chromosomal anomalies and genetic syndromes. The incidence of CHD is 6 times greater than chromosomal abnormalities and 4 times greater than neural tube defect [1].

Congenital heart anomalies have a significant effect on affected children's life with up to 25:35% mortality rate during pregnancy and the postnatal period, and 60% of this mortality occurs during the first year of life. Moreover, major CHD are responsible for nearly 50% of all neonatal and infant death due to congenital anomalies and it is likely to be significantly higher if spontaneous abortions are considered [1].

Prenatal detection of fetal congenital heart defects (CHD) remains the most problematic issue of prenatal diagnosis. Most major CHD can be diagnosed prenatally by detailed transabdominal second trimester echocardiography at 20:22 weeks gestation. The identification of pregnancies at high-risk for CHD needing referral to specialist centers is for paramount importance in order to reduce the rate of overlooked defects [2].

However, the main problem in prenatal diagnosis of CHD is that the majority of cases take place in pregnancies with no identifiable risk factors. Therefore, there is wide agreement that cardiac ultrasound screening should be introduced as an integral part of the routine scan at 20 to 22 weeks. When applied to low-risk population, the four-chamber view allows only the detection of 40% of the anomalies, while additional visualization of the outflow tract and the great arteries increase the rate up to 60 to 70% [3].

Since earlier diagnosis of congenital malformations is increasingly demanded, the option of an early fetal echocardiography must be taken into account [4].

Recently, the finding of an increased nuchal translucency [5] or an altered ductus venosus blood [6] at 10 to 14 weeks` gestation has been associated with high-risk for CHD and their prevalence increase with the thickness of nuchal translucency regardless of the fetal karyotype [5].

The use of high-frequency vaginal ultrasound probes along with substantial improvements in magnification and processing of the imaging, together with the introduction of color doppler have extensively contributed the development of the technique, allowing better visualization of cardiac structures earlier in pregnancy [6].

Despite several studies that stated that fetal cardiac examination could be incorporated in first or early second trimester examinations, it`s use is still debated and it`s accuracy needs more research. Aim of the work to evaluate the value of fetal echocardiography and measuring of fetal nuchal translucency thickness in first and early second trimester in prediction of fetal congenital heart disease.

2. PATIENTS AND METHODS

A prospective observational cohort study was conducted on 200 pregnant women attended to Tanta University Hospital, Department of Obstetrics and Gynecology at outpatient clinic or inpatient, the study took from January 2019 to December 2020.

2.1 Inclusion Criteria

*Any pregnant female between 12:16 weeks gestation.

2.2 Exclusion Criteria

*Patient refusing to participate.
*Pregnancy terminated befor second scan (befor 24 weeks of gestation)

All patients submitted to the study were counseled thoroughly about the procedure including its value and hazards, and the aim of the study. After this, a written consent was obtained and signed by the patient.

This study was carried out without any external funds. If the patient refused to complete the study, she was excluded and replaced by another one from who are fulfilling the inclusion criteria of the study. There was no classification of the patients according to their religion or culture or race or any other unrelated points in that study.

All patients were subjected to the following:

1. Personal history: name, age, occupation, residency, special habits and diseases.
2. Husband history: name, age, occupation, residency, special habits and diseases.
3. Past history: medical disease, abdominal surgeries, drug therapy or allergy.
4. Menstrual history.
5. Obstetric history.
6. General and local examination to exclude general and local disease.
7. Patients underwent transabdominal fetal echocardiography at 10:16 weeks of gestation. transvaginal scan was also performed when needed.

The first step in fetal cardiac ultrasound is to evaluate the orientation of the fetal laterality (presentation and lie).

Establishing situs and atrial arrangement, Five short-axis views of heart. First view is acquired in abdomen at level of stomach to identify situs.

The basic view performed in cardiac ultrasound is the four-chamber view, Standard cardiac view, which shows right ventricle (RV), left ventricle (LV), right atrium (RA), and left atrium (LA). The tricuspid valve opens into the RV and the mitral valve opens into the LV. Interventricular septum is also seen in this view that is acquired perpendicular to ultrasound beam.

Interatrial septum is visualized. The cardiac chambers and vascular structures are measured and can be compared with normalized charts.

Extended basic views" A, Left ventricular outflow tract view shows left ventricle (LV), which gives origin to ascending aorta (AO). Right ventricular (RV) outflow tract and left atrium (LA) are also seen.

B, Right ventricular outflow tract view shows RV, giving origin to main pulmonary artery (PA). AO is seen as circular structure and is perpendicular to PA. C, Further superiorly, right pulmonary artery (RPA) and left pulmonary artery (LPA) are seen.

The Five-chamber view acquired just cephalad to fourchamber view shows centrally placed aorta in addition to chambers.

Further cephalad motion shows three-vessel view, which shows main PA, ascending AO, and superior vena cava (SVC) from left anterior to right posterior aspect of thorax.

HR is also evaluated in each case compared to normal values for this GA.

8. A transabdominal ultrasound examination performed to record an image of the maximal NT thickness, Transvaginal scans were performed in cases where inadequate nuchal views obtained transabdominally.

Standard technique of nuchal translucency measurement:

* Gestation should be limited to between 10 weeks 3 days and 13weeks 6 days (approximate fetal crown–rump length, 36–80 mm).
* Fetus should be examined in a midsagittal plane
* Fetal neck should be in a neutral position
* Fetal image should occupy at least 75% of the viewable screen
* Fetal movement should be awaited to distinguish between amnion and overlying fetal skin.
*Calipers should be placed on the inner borders of the nuchal fold
* Calipers should be placed perpendicular to the long axis of the fetal body.
*At least three nuchal translucency measurements should be obtained, with the mean value of those used in risk assessment and patient counseling. NT Cut off value used in this study was 3.5 mm
*At least 20 minutes might need to be dedicated to the nuchal translucency measurement before abandoning the effort as failed.
*patients with increased NT > 3.5 mm were counceled for further follow up by

karyotyping,second trimester ultrasound and echocardiography.

2.3 Criteria for Normal Scans

*Normal sequential segmental analysis, symmetrical four-chamber view, normal semilunar valves, arterial outflow tracts, and ductal and aortic arches.
*Normal Nuchal translucency thickness measurement in viable pregnancies at 10:16 weeks, in this study 3.5 mm is the start of considered abnormal NT.

9. Patients repeated transabdominal fetal echocardiography at 20:24 weeks.
10. Ultrasound was done using SAMSUNG-USS-H60NF4K/WR, S/N:SOTYM3HF900003A.
11. Postnatal data were recorded:

- Time of termination of pregnancy and its indication if time of termination was before maturity.
- Adverse pregnancy outcomes
- Diagnosis of neonatal major cardiac or extra cardiac abnormality.
- neonatal chromosomal defects
- intrauterine death
- Early neonatal death

12. Correlation between the data obtained from the late first and early second trimester, data of repeated fetal echocardiography and postnatal data by proper Statistical analysis was done.

2.4 Statistical Analysis

The data was collected and entered into Microsoft Excel Database to be analyzed using the Statistical Package for Social Science (SPSS Inc., Chicago, version 22). Quantitative variables were described in the form of mean ± standard deviation and median (range). Qualitative variables were described as number and percent. In order to compare normally distributed quantitative variables between three studied groups, ANOVA test was performed, Kruskal-Wallis H test was used instead for non-normally distributed quantitative variables. Qualitative variables were compared using $\chi 2$ test or Fisher's exact test when the expected frequency is less than 5. P value < 0.05 is considered significant.

3. RESULTS

Table 1. Patients' characteristics of all studied patients

Patients (n = 200)		
Age (Years)	Mean ± SD	4.47 ± 23.91
	Range	17-39
BMI (Kg/m^2)	Mean ± SD	6.32 ± 27.45
	Range	16.2-46.9

The age of all studied patients ranged from 17-39 years with a mean value 23.91 ± 4.47 years.

The BMI of all studied patients ranged from 16.2-46.9 kg/m^2 with a mean value 27.45 ± 6.32 kg/m^2.

Table 2. Gravidity and parity of all studied patients

Patients (n = 200)		
	Median	1
	Range	1-4
	G1	(54%) 108
	G2	(16.5%) 33
	G3	(19.5%) 39
Gravidity	G4	(10%) 20
	Median	0
	Range	0-3
	P0	(55%) 110
	P1	(19.5%) 39
	P2	(19.5%) 39
Parity	P3	(6%) 12

The gravidity of all studied patients ranged from 1-4 with a median value 1. There were 108 (54%) patients with G1, 33 (16.5%) patients with G2, 39 (19.5%) patients with G3 and 20 (10%) patients with G4.

The parity of all studied patients ranged from 0-3 with a median value 0. There were 110 (55%) patients with P0, 39 (19.5%) patients with P1, 39 (19.5%) patients with P2 and 20 (10%) patients with P3.

As regard to maternal risk factors, 80 (40%) patients had anemia, 57 (28.5%) patients were obese, 12 (6%) patients were had history of fetal congenital heart, 11 (5.5%) patients hypertensive, 10 (5%) patients diabetic,3 (1.5%) patients had FMF and 3 (1.5%) patients had hyperthyroidism.

Table 3. Maternal risk factors of all studied patients

	Patients (n = 200)
Anemia	(40%) 80
Obesity	(28.5%) 57
History of fetal congenital heart	(6%) 12
Hypertension	(5.5%) 11
Diabetes mellitus	(5%) 10
FMF	(1.5%) 3
Hyperthyroidism	(1.5%) 3

FMF: Familial Mediterranean Fever

Table 4. First scan at 10:16 weeks of all studied patients

		Patients (n = 200)
Fetal Echo	Normal	(97%) 194
	VSD	(2.5%) 5
	Single ventricle defect	(0.5%) 1
Nuchal translucency	Normal	(96.5%) 193
	Abnormal	(3.5%) 7

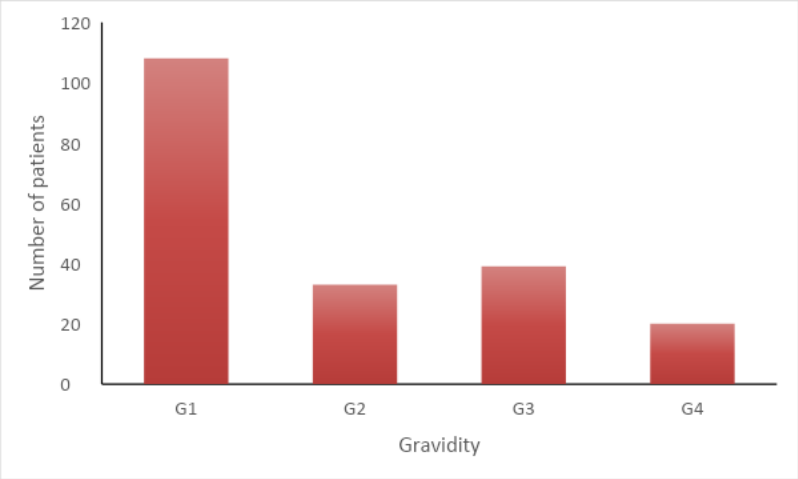


Fig. 1. Gravidity of all studied patients

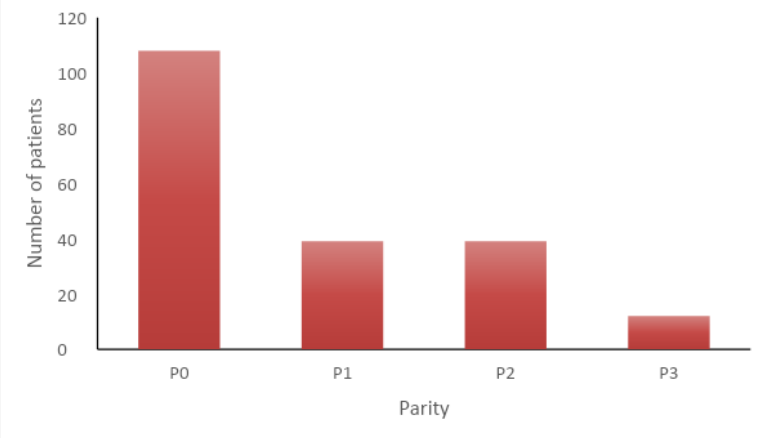


Fig. 2. Parity of all studied patients

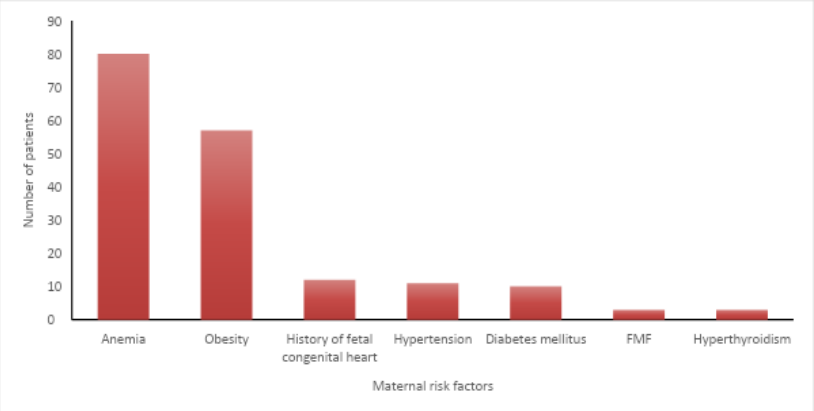


Fig. 3. Maternal risk factors of all studied patients

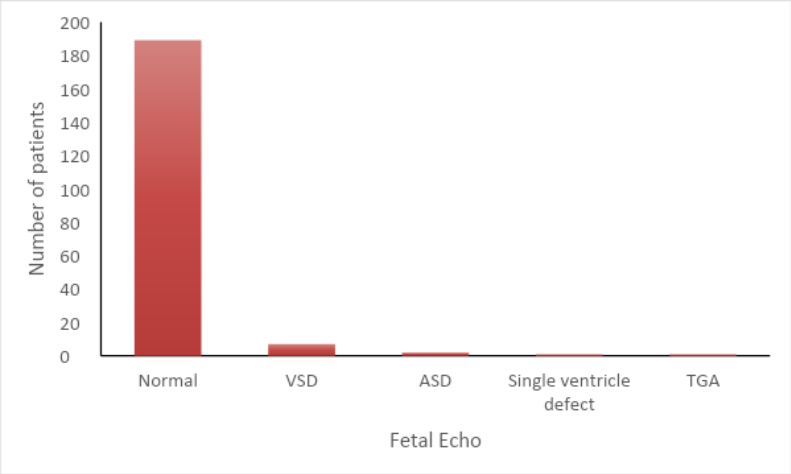


Fig. 4. Fetal Echo at 2nd scan of all studied patients

As regard to 1st fetal Echo at 10:16 weeks, 194 (97%) fetuses were normal, 5 (2.5%) fetuses had VSD and one fetus (0.5%) had single ventricle defect.

As regard to nuchal translucency, 193 (96.5%) fetuses were normal and 7 (3.5%) fetuses were abnormal at 10:16 weeks.

Table 5. Second scan at 20:24 weeks of all studied patients

	Patients (n = 200)	
Fetal Echo	Normal	(94.5%) 189
	VSD	(3.5%) 7
	ASD	(1%) 2
	Single ventricle defect	(0.5%) 1
	TGA	(0.5%) 1

As regard to 2nd fetal echo at 20:24 weeks, 189 (94.5%) fetuses were normal, 7 (3.5%) fetuses had VSD, 2 (1%) patients had ASD, one fetus (0.5%) had single ventricle defect and one fetus (0.5%) had TGA.

The gestational age at delivery ranged from 30-40 weeks with a mean value 39.0 ± 1.35 weeks.

As regard mode of delivery, cesarean section was in 119 (59.5%) patients were and vaginal delivery was in 81 (40.5%) patients.

VSD follow up was in 6 (3%) cases, preterm was in 4 (2%) cases were, IFUD was in 3 (1.5%) neonates, ASD follow up was 2 (1%) neonates and TGA+NICU was in one (0.5%) case.

There were 186 (93%) patients with normal neonate (one of them was abnormal by Echo), 7 (3.5%) patients delivered a neonate with VSD, 3 (1.5%) patients were delivered a neonate with ASD, 3 (1.5%) patients were with neonates

having IUFD, and one patient (0.5%) was with a neonatal death.

To predict congenital heart disease (compared to results of first Echo), nuchal translucency had 83.33% sensitivity, 98.97% specificity, 71.43% PPV, 98.50% NPV and 99.48% accuracy.

To predict congenital heart disease (compared to results of first Echo), nuchal translucency had 63.64% sensitivity, 100.00% specificity, 100.00% PPV, 97.93% NPV and 98.00% accuracy.

To predict congenital heart disease (compared to fetal outcome), nuchal translucency had 83.33% sensitivity, 98.97% specificity, 71.43% PPV, 99.48%% NPV and 98.50% accuracy.

Table 6. Outcome of all studied patients

		Patients (n = 200)
Gestational age at delivery weeks	Mean ± SD	1.35 ± 39.0
	Range	30-40
Mode of delivery	Cesarean section	(59.5%) 119
	Vaginal delivery	(40.5%) 81
Complication s	VSD follow up	(3%) 6
	ASD Follow Up	(1%) 2
	TGA+NICU	(0.5%) 1
	Preterm	(2%) 4
Neonate outcome	IUFD	(1.5%) 3
	Normal	(93%) 186
	VSD	(3.5%) 7
	ASD	(1.5%) 3
	IUFD	(1.5%) 3
	Neonatal death	(0.5%) 1

Table 7. Diagnostic role of nuchal translucency at 10:16 weeks in prediction of congenital heart disease compared to results of first Echo at 10:16 weeks

		1st Echo		
		Abnormal		Normal
Nuchal translucency	Abnormal	5		2
	Normal	1		192
Sensitivity	Specificity	PPV	NPV	Accuracy
83.33%	98.97%	71.43%	99.48%	98.50%

,PPV: positive predictive value, NPV: negative predictive value

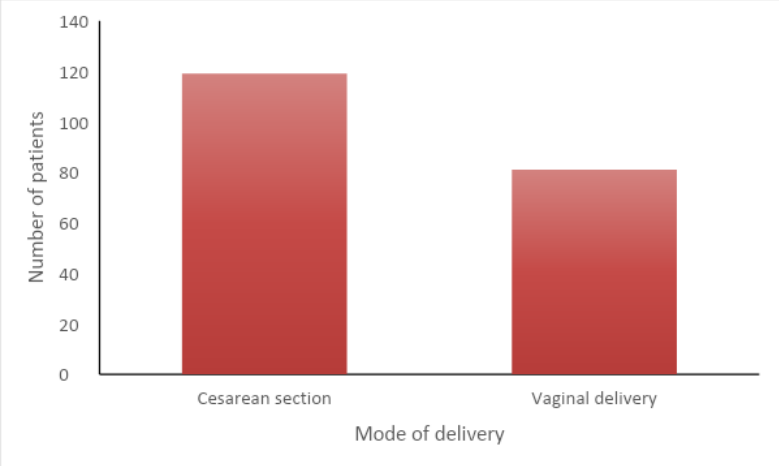


Fig. 5. Mode of delivery of all studied patients

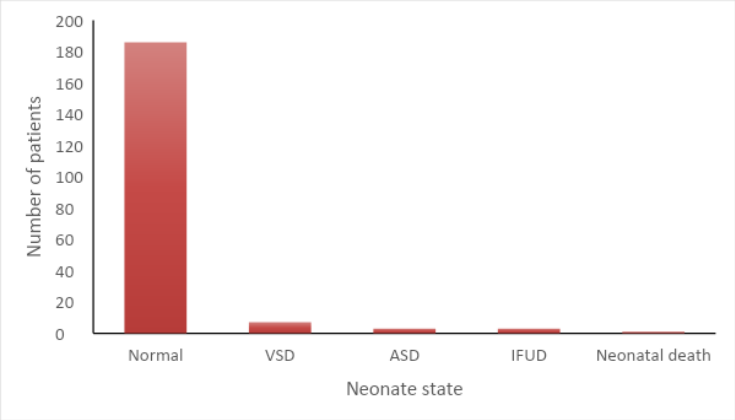


Fig. 6. Complications of all studied patients

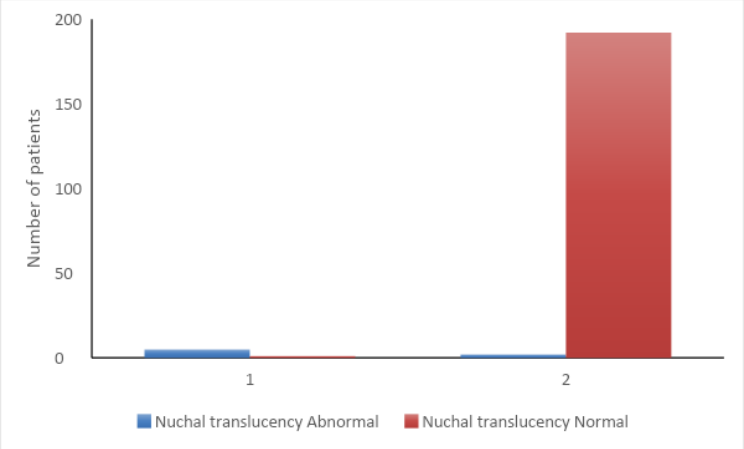


Fig. 7. Relationship between nuchal translucency and first Echo at 10:16 weeks in detection of congenital heart disease

Table 8. Diagnostic role of nuchal translucency at 10:16 weeks in prediction of congenital heart disease compared to results of 2nd Echo at 20:24 weeks

		2nd Echo		
		Abnormal		**Normal**
Nuchal translucency	Abnormal	7		0
	Normal	4		189
Sensitivity	Specificity	PPV	NPV	Accuracy
63.64%	100.00%	100.00%	97.93%	98.00%

,PPV: positive predictive value, NPV: negative predictive value

Table 9. Diagnostic role of nuchal translucency at 10:16 weeks in prediction of congenital heart disease compared to fetal outcome

		Fetal outcome		
		Abnormal		**Normal**
Nuchal translucency	Abnormal	5		2
	Normal	1		192
Sensitivity	Specificity	PPV	NPV	Accuracy
83.33%	98.97%	71.43%	99.48%	98.50%

,PPV: positive predictive value, NPV: negative predictive value

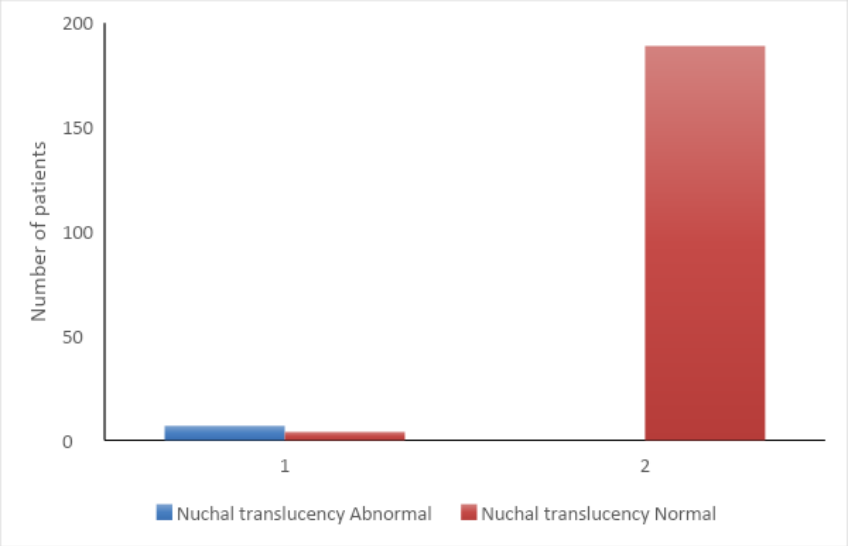


Fig. 8. Relationship between nuchal translucency at 10:16 weeks and second Echo at 20:24 weeks in detection of congenital heart disease

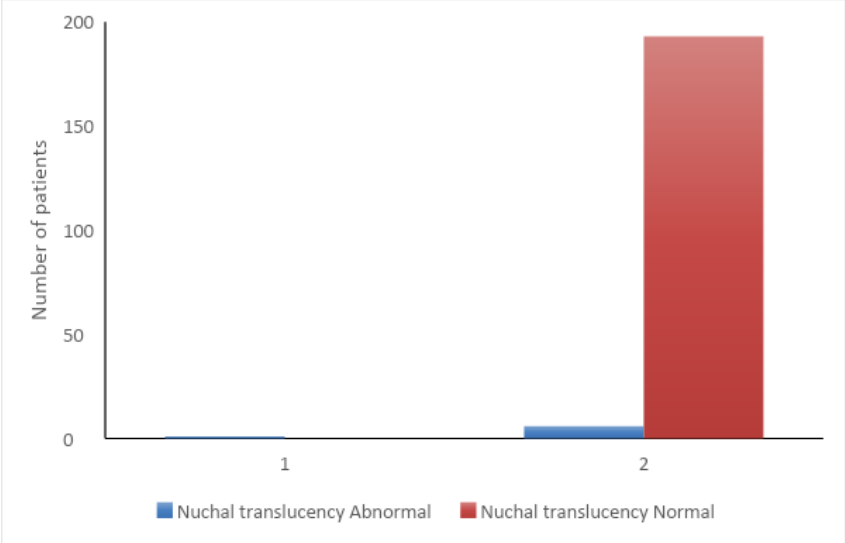


Fig. 9. Relationship between nuchal translucency at 10:16 weeks and fetal outcome in detection of congenital heart disease

Table 10. Diagnostic role of 1st Echo at 10:16 weeks in prediction of congenital heart disease compared to fetal outcome

		Fetal outcome		
		Abnormal		**Normal**
1st Echo	Abnormal	5		1
	Normal	6		188
Sensitivity	Specificity	PPV	NPV	Accuracy
45.45%	99.47%	83.33%	96.91%	96.50%

PPV: positive predictive value, NPV: negative predictive value

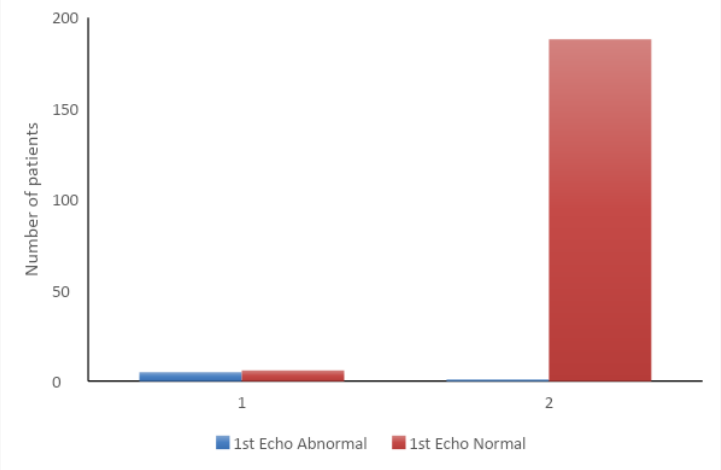


Fig. 10. Relationship between 1st Echo at 10:16 weeks and fetal outcome in detection of congenital heart disease

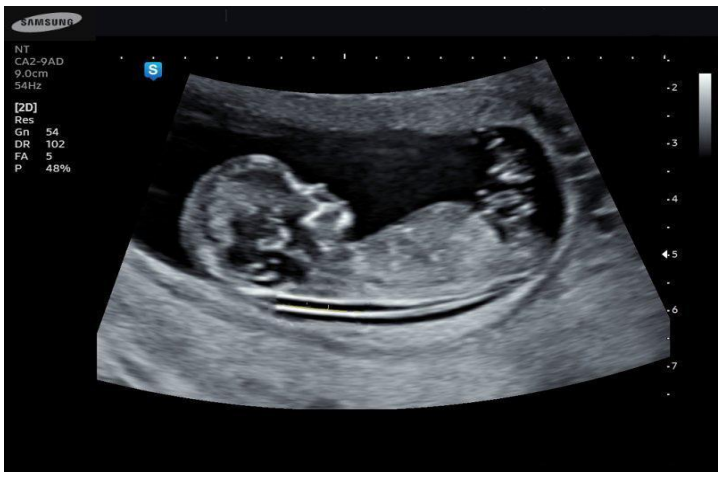


Fig. 11. Normal nuchal translucency in a normal fetus in the 13th week of gestation measuring 0.21 cm in grayscale

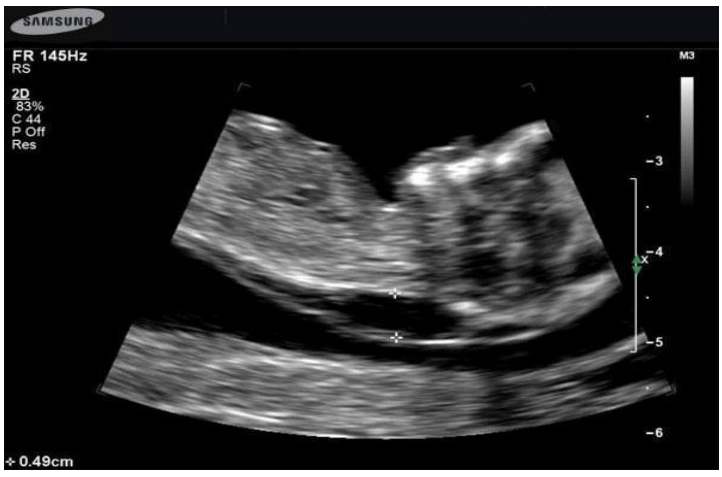
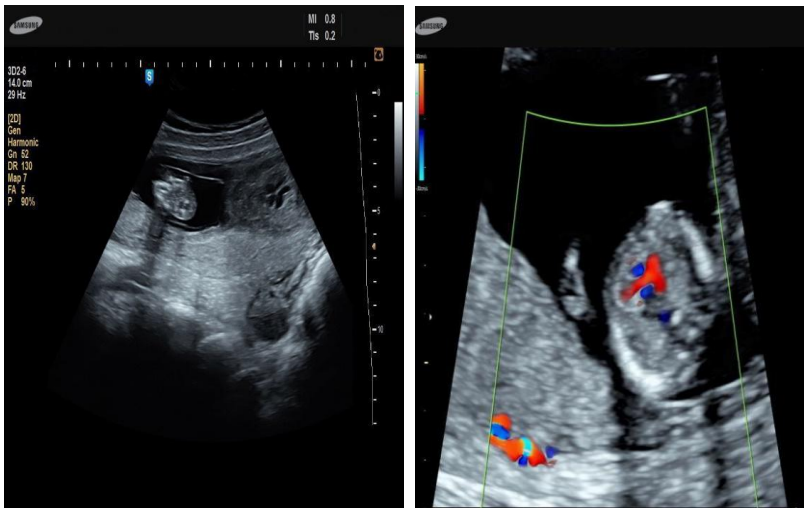


Fig. 12. Increased nuchal translucency in a fetus in the 12th week of gestation. Measuring 0.49 cm in grayscale



(A) **(B)**

Fig. 13. Normal fetal echo, Four-chamber view in anormal fetus at 12w5d shows all chambers and valves, inter atrial septum is seen in this view, Interventricular septum is also seen in this view that is acquired perpendicular to ultrasound beam .(in grayscale (A) and colour Doppler (B)

To predict congenital heart disease (compared to fetal outcome), 1st Echo had 45.45% sensitivity, 99.47% specificity, 83.33% PPV, 96.91% NPV and 96.50% accuracy.

4. DISCUSSION

Congenital heart disease (CHD) is the single most common congenital abnormality present at birth. It contributes substantially to morbidity and mortality among newborns and has been shown to be associated with the highest mortality among all congenital anomalies [7].

Fetal echocardiography (FE) in the second and third trimesters permits the prenatal diagnosis of most major structural CHD and has led to improved neonatal outcomes through planned delivery and neonatal management [8]. FE in pregnancies at risk for fetal CHD is typically offered between 18 and 22 weeks. Most forms of structural CHD can be diagnosed with significant accuracy, approaching 96%, after 18 weeks' gestational age (GA) [9].

With the advent of higher frequency high-resolution transducers and earlier obstetric screening for fetal pathology, including nuchal translucency assessment at 11 to 14 weeks, maternal serum screening, and noninvasive prenatal testing, there has been an increasing interest in early fetal cardiac assessment. Other authors have shown that FE at 12 to 16 weeks' gestation provides near complete assessment of the fetal heart structure, which includes evaluation of systemic veins, four chambers, ventricular outflow tracts, great arteries, and arches [10].

This prospective observational cohort study was conducted at department of obstetrics and gynecology at Tanta University at outpatient clinic or inpatient, the study took 24 months from January2019 To December2020.

This study evaluated the value of fetal echocardiography and measuring of fetal nuchal translucency thickness in first and early second trimester in prediction of fetal congenital heart diseases.

The participants of this study were any 200 pregnant women attending to Tanta University Hospital with gestational age between 10:16 weeks.

All patients were subjected to full personal history, husband history, past history, menstrual history and obstetric history. General and local examinations were done. Women underwent nuchal translucency thickness measurement and trans abdominal fetal echocardiography at 10:16 weeks. Transvaginal scans were performed in cases where inadequate views obtained trans-abdominally. Patients repeated

trans abdominal fetal echocardiography at 20:24 weeks.

As regard to 1st fetal Echo at 10:16 weeks, statistical analysis of current study showed that 194 (97%) fetuses were normal, 5 (2.5%) fetuses had VSD and one fetus (0.5%) had single ventricle defect. As regard to nuchal translucency, 193 (96.5%) fetuses were normal and 7 (3.5%) fetuses were abnormal at 10:16 weeks.

Batra et al assess the feasibility of fetal cardiac evaluation at 11–13+6 weeks by assessing the four chamber and three vessel views, to assess detection rates of cardiac anomalies at this gestational age. This was a prospective study done over 1 year. It included 355 patients at 11–13+6 weeks corresponding to a CRL of 45–84 mm Nuchal translucency was also measured in both gray scale and color Doppler using trans abdominal scanning and trans vaginal scanning. A follow-up was done at 18–22 weeks and at delivery. Overall detection of major fetal cardiac anomalies at 11–13+6 weeks was 1.4 % and noncardiac anomalies was 3.9 %. This supports the results of current study that first trimester can be used for detection of major congenital heart diseases [11].

Clur et al investigated the congenital heart disease (CHD) found in association with an increased nuchal translucency (NT) at11–14 weeks of gestation in chromosomally normal and abnormal fetuses. Patients referred with an increased NT (≥95th percentile) where CHD was diagnosed were included. They agreed with current results and stated that variety of CHD is associated with an increased NT in the first trimester of pregnancy. Major CHD was identified in 68 of 967 fetuses with an increased NT (median NT 4.8 mm, range 2.5–22 mm) [12].

Regarding diagnostic role of nuchal translucency at 10:16 weeks in prediction of congenital heart disease compared to results of first Echo at 10:16 weeks, nuchal translucency had 83.33% sensitivity, 98.97% specificity, 71.43% PPV, 98.50% NPV and 99.48% accuracy.

Hyett et al examined the utility of measuring fetal nuchal translucency thickness in screening for major defects of the heart and great arteries at 1014 weeks of gestation. They agreed with current study and reported that measurement of fetal nuchaltranslucency thickness at 1014 weeks of gestation can identify a large proportion of fetuses with major defects of the heart and great arteries. In a hort of 29154 pregnancies, pregnancies with fetal nuchal translucency thicknesses above the 95th centile of the normal range. The positive and negative predictive values for this cut off point of nuchal translucency thickness were 1.5% and 99.9% respectively [13].

In a meta-analysis including 58492 fetuses, Makrydimas et al evaluated the screening performance of increased first-trimester nuchal translucency for the detection of major congenital heart defects. They disagreed with current study and found that a NT measurement > 99th percentile had a sensitivity of 31 % which is much lower than current study and specificity of 98.7 %, with a positive likelihood ratio of 24 for the diagnosis of major CHD. A sensitivity of 37 % and specificity of 96.6 % was found using the 95th percentile cut-off This disagreement is due to different methodology and sample sizes [14].

Simpson et al estimated whether nuchal translucency assessment is a useful screening tool for major congenital heart disease (CHD) in the absence of aneuploidy. They disagreed with current results and found a sensitivity of only 15.4 % using 2.0 multiples of the median (MoM) in a prospective study of 34622 fetuses, but their low detection may be explained by the exclusion of the septated cystic hygroma. If they had included the septated cystic hygroma, their detection of the CHD would have been 35,3% [15].

As regard to 2nd fetal echo at 20:24 weeks, statistical analysis of current study showed that 189 (94.5%) fetuses were normal, 7 (3.5%) fetuses had VSD, 2 (1%) patients had ASD, one fetus (0.5%) had single ventricle defect and one fetus (0.5%) had TGA.

Lombardi et al assess the feasibility of performing a fetal cardiac study assessed the fetal heart in pregnancies with a fetal crown–rump length (CRL) of 60–84 mm that had been referred for NT screening. total of 608 fetuses with a median CRL of 65 mm was examined between 2003 and 2005. In 571/608 (94%) the risk for congenital heart disease (CHD) was not increased and the heart was considered normal at initial echocardiography; this was confirmed by later scans and at postnatal follow-up. In 37/608 (6%) fetuses the risk for CHD was increased (35 for NT >95th

centile and two for family history). In this group normal heart anatomy was described in 34 fetuses and confirmed by subsequent specialist echocardiography. Cardiac defects were suspected in three fetuses (all with increased NT) and confirmed by a fetal cardiologist in each case [16].

Regarding diagnostic role of nuchal translucency at 10:16 weeks in prediction of congenital heart disease compared to results of 2nd Echo at 20:24 weeks, nuchal translucency had 63.64% sensitivity, 100.00% specificity, 100.00% PPV, 97.93% NPV and 98.00% accuracy. In prediction of major congenital heart disease and fetal outcome, nuchal translucency had 83.33% sensitivity, 98.97% specificity, 71.43% PPV, 99.48%% NPV and 98.50% accuracy.

Galindo et al examined the prevalence, distribution and spectrum of cardiac defects in chromosomally normal fetuses with increased nuchal translucency thickness. During a 4-year period, targeted fetal echocardiography was used in 353 chromosomally normal fetuses with increased nuchal translucency thickness at 10–14 weeks' gestation. The cardiac scan was performed at 18–22 weeks. In the last 138 cases enrolled, an additional scan at 12–16 weeks was carried out. They agreed with current results and found that cardiac defects were present in 32 (9.1%) cases, increasing from 5.3% in those with a nuchal translucency thickness of ³ 95th centile (3.9 mm) to 24% when thickness ³ 6 mm (p< 0.001). In 31 cases (97%), the cardiac defect was diagnosed antenatally; in 24 cases (77%) this diagnosis was confirmed later. In the remaining seven cases, the autopsy examination was not available [17].

Statistical analysis of current study showed that the gestational age at delivery ranged from 30-40 weeks with a mean value 39.0 ± 1.35 weeks. As regard mode of delivery, cesarean section was in 119 (59.5%) patients were and vaginal delivery was in 81 (40.5%) patients. As regard neonatal complications and outcomes, VSD follow up was in 6 (3%) cases, preterm was in 4 (2%) cases were, IFUD was in 3 (1.5%) neonates, ASD follow up was 2 (1%) neonates and TGA+NICU was in one (0.5%) case. There were 186 (93%) patients with normal neonate (one of them was abnormal by Echo), 7 (3.5%) patients delivered a neonate with VSD, 3 (1.5%) patients were delivered a neonate with ASD, 3 (1.5%) patients were with neonates having IUFD, and one patient (0.5%) was with a neonatal death.

Lithner et al investigated pregnancy outcome for fetuses with nuchal translucency (NT) >3.5mm but normal karyotype in the Stockholm (Sweden) area. A retrospective population-based cohort study, fetal NT was measured in 55123 singleton pregnancies. There were 341 pregnancies with NT thickness >3.5 mm; 139 had a normal karyotype, 164 had an abnormal karyotype and 38 were removed from the study. They disagreed with current study and stated that of the 139 high NT pregnancies with normal karyotype, 110 (79.2%) resulted in live births, one (0.7%) IUFD, 23 (16.5%) TOP and five (3.6%) MC. The risk of an adverse pregnancy outcome increased with increasing NT. Structural fetal defects were found in 28 (19.5%) of pregnancies undergoing second trimester ultrasound screening, of which seven resulted in live births and 21 were terminated. The most common structural defect was cardiac defects. The differences with current study may due very large sample size in comparison with current study [18].

Carvalho et al evaluated the clinical impact of fetal echocardiography before 16 weeks' gestation on the management of pregnancies with fetuses at risk of congenital heart disease.

222 consecutive women with high-risk pregnancies (230 fetuses) underwent transabdominal fetal echocardiography at a median gestation of 14+1 weeks. For 10%, transvaginal scans were also performed. Early scans were compared with mid-second trimester fetal echocardiography. Postmortem and postnatal data were added. There were 21 abnormal cardiac scans (9%): 14 major structural defects in pregnancies resulting in three live births, one intrauterine death, and 10 terminated pregnancies. Seven scans showed asymmetry between right and left sided structures six of the seven pregnancies were terminated. The scans were normal in 199 cases (87%). Cardiac follow up of 184 of 199 babies (93%) confirmed situs and connections. One case each of pulmonary stenosis and ventricular septal defect requiring postnatal intervention were diagnosed at later scans. In 28 of 199 (14%) babies there was a non-cardiac adverse outcome. First examination was not diagnostic for 10 (4%) [19].

According to our knowledge there were no previous studies assessed neither the gestational age of termination nor the mode of delivery of study population.

To eliminate bias every effort was made to ascertain that all follow-up data were correct, and only complete information was included in data analysis, all sonographic examinations were done by the same team and assessment of study outcomes was done by the same observer.

5. CONCLUSION

Fetal echocardiography and measuring of fetal nuchal translucency thickness in first and early second trimester have good sensitivity in prediction and better specificity in exclusion of fetal congenital heart diseases.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This study was conducted with approval from the Ethics Committee of Tanta University Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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