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FIRST TRIMESTER NUCHAL TRANSLUCENCY SCREENING: A WINDOW INTO EARLY FETAL HEALTH

Anatomy

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ABSTRACT

Background/Aim: The aim of this study was to increase awareness and significance of early anomaly scan by observing fetal nuchal translucency (NT) thickness values in first trimester in a Central Indian population and compare them with different ethnic races. **Material and Methods:** Ultrasonographic measurements of crown-rump length (CRL) and NT thicknesses were obtained from 11-14 weeks of gestation in a Central Indian population. 100 pregnant women with singleton pregnancy and fetal CRL between 45 and 84 mm were included in the study. The mean 1st, 3rd, 5th, 50th, 90th, 95th, 97th, and 99th percentiles and fixed cut off values of ≥ 1.5 mm, ≥ 2mm, ≥ 2.5 mm NT thicknesses for a CRL between 45 and 84 mm were determined. **Results:** The sonographic measurements were performed on 100 pregnant women by transabdominally route. The mean NT thickness for CRL between 45 and 84 mm was 1.48 ± 060 mm, and the mean 95th, 97th, and 99th percentiles of these values were 2.40 mm, 2.75mm, and 2.95 mm, respectively. The incidence of NT thicknesses at fixed points of ≥ 2.5 mm in normal fetuses were 2.0%. **Conclusion:** The present study demonstrated the nomogram and increased data of fetal NT thickness in a Central Indian population. This data will be useful for further research related to NT thickness values on the prenatal diagnosis for the first trimester chromosomal and non chromosomal abnormalities.

KEYWORDS

Nuchal Translucency, Ultrasonography, First Trimester, Crown-Rump Length, Early Anomaly Scan

An Early Anomaly Scan, also known as a first-trimester anomaly scan or 11-14 week scan, is an ultrasound examination performed between 11 and 14 weeks of pregnancy. This scan is designed to detect structural abnormalities and assess fetal development at an early stage. It helps us in early reassurance and provides early insights into fetal health and development.[1,2].

Early Anomaly Scan is a valuable prenatal screening tool that provides information about (1)Detection of Structural Abnormalities (2)Assessment of Nuchal Translucency (NT) (3)Confirmation of Pregnancy Details (4)Evaluation of Fetal Anatomy (5)Detection of Uterine and Placental Abnormalities and(6)Monitoring Maternal Health [3].

Nuchal translucency (NT) is a measurement of fluid-filled space at the back of a fetus's neck, which can be measured via ultrasound during the first trimester of pregnancy (typically between 11 and 14 weeks of gestation) and is one of the parameter of early anomaly scan. It is a screening test not a diagnostic test [4].

The importance of NT screening lies in its ability to provide early insights into fetal health.
(1.) Early detection of chromosomal abnormalities like Down syndrome, Trisomy18, and Trisomy13. Higher NT is associated with risk of genetic abnormalities. When combined with tests like Beta HCG & PAPP-A, this improves the accuracy of risk.(2) Identification of Structural Defects, congenital heart defects, skeletal dysplasia and diaphragmatic hernia.(3.)Non-invasive and safe screening procedure.(4.)Helps in decision-making, in case if NT results are abnormal,additional tests such as non-invasive prenatal testing (NIPT), chorionic villus sampling (CVS), or amniocentesis may be considered.(5.)If NT screening is combined with factors like maternal age, blood tests, and gestational age to give a personalized risk estimate for chromosomal abnormalities[5].

Thus Early Anomaly Scan is a valuable prenatal screening tool that provides important information about the fetus's health and development. It supports early decision-making, better management of there by contributing to positive outcomes for both mother and baby[6].

The aim of this study is to increase the awareness and significance of NT scan during early pregnancy among females . The objectives of the study are : i) To observe NT scan values (both normal and abnormal scan) in 100 female patients attending OBGY OPD during 1st trimester.
ii) To counsel them about the importance of NT Scan.
iii) To compare NT scan values with different ethnics origin with Central Indian population .

MATERIALAND METHODS

In this prospective observational study, pregnant women referred from OPD of Department of OBGY to private radiological center for ultrasonographic assessment during the antenatal visit in their first trimester were enrolled. This study was perfomed on 100 singleton pregnant females from January'2020 to December'2024 in Department of Anatomy at LN Medical College & JK Hospital, Bhopal.

All healthy singleton pregnant women of all age group attending OBGY OPD of gestational age (GA) between 11-14 weeks were included as a part of study. Ultrasound measurements of CRL and NT were performed in them. Pregnant females having twin pregnancy, diabetes mellitus, thyroid disorders, anemia, hypertension, TORCH infections and any other complications were excluded from the study.

The study protocol was approved by Institutional Ethics committee. Written informed consent was obtained from all the participants.

Sonographic Criteria was maintained to maximize quality of nuchal translucency:-
Sonographic Assessment & Measurement Technique

NT is measured using a sagittal ultrasound scan of the fetal neck:
- Proper fetal positioning: The midsagittal plane should be aligned, with the vertebral column oriented at the bottom of the image.
- Essential anatomical landmarks include:
  - Two parallel echogenic lines
  - Tip of the nose
  - Nasal bone
  - Hard palate
- Image magnification: The fetal head and upper thorax should fill the screen to allow precise measurement increments of 0.1 mm.
- Floating fetal position: Amniotic fluid should be visible between the fetus and uterine wall.
- Measurement method:
  - Calipers should be placed inside the hyperechoic edges of the NT space.
  - The widest section of NT should be recorded.
  - Only the lucent region is measured, differentiating it from nuchal thickness.

Statistical Analysis

Statistical analysis was performed by Statistics Package for Social Science (SPSS) 10.0 computer software. A p value of <0.05 was considered statistically significant.

RESULTS

In the present study, 100 pregnant women were evaluated. Out of which 29%, 49%, 22% were in the 11th, 12th and 13th gestational week respectively.

In the population under study, the average GA, CRL, and NT thickness were 12.80±0.755 weeks, 64.83±1.47mm, and 1.43 ±0.27 mm respectively.

Increased NT thickness (NT >2.5 mm) was detected in 2 (2.81%) pregnant women.

Table 1 shows the mean CRL and GA for pregnant women with normal and increased NT thickness.

Table 1: Mean ± SD of CRL and GA in Pregnant Women with Normal and Increased NT Thickness

Table 1: Mean +_ of CRL and GA in Pregnant women with normal and increased NT thickness			
Variables	Pregnant women with normal NT thickness	Pregnant women with Increased NT thickness	P Value
CRL (mm)	64.83±1.47	69.50±1.50	0.05
Gestational age (weeks)	12.80±0.755	13.50±0.707	0.05

A significant positive correlation was found using the Pearson correlation test between CRL and NT (r=0.997, p<0.05) NT and GA (r=0.998 p<0.05) GA and CRL (r = 0.913, P < 0.05).

Table 2: The Percentile Values of the NT Thicknesses for 10 mm CRL Intervals.

Percentile												
Weeks	CRL	N	Mean ± SD	1%	3%	5%	10 %	50 %	90 %	95 %	97 %	99 %
11-11+6	45-54	22	1.30 ± 0.55	0.50	0.55	0.60	0.75	1.30	1.90	2.20	2.40	2.60
12-12+6	55-68	51	1.50 ± 0.60	0.55	0.60	0.70	0.85	1.50	2.10	2.40	2.55	2.65
13-13+6	69-84	27	1.60 ± 0.65	0.60	0.65	0.75	0.95	1.60	2.25	2.50	2.65	2.72
Total (11-13+6)	45-84	100	1.48 ± 0.60	0.55	0.60	0.70	0.85	1.50	2.10	2.40	2.65	2.72

In the present study, mean NT measurements at 11 11+6, 12-12+6, and 13–13+6 gestational weeks were 1.30 ± 0.55 mm, 1.50 ± 0.60 mm, and 1.60 ± 0.65 mm, respectively. NT thickness for the 95th, 97th, and 99th percentiles were 2.40 mm, 2.65 mm, and 2.72 mm, respectively. The Pearson correlation analysis showed a significant and positive correlation between NT and CRL (r = 0.131 and P < 0.001).

Table 3 :The Distribution of Nuchal Translucency Measurements According to 1 mm, 1.5 mm, 2mm and 2.5 mm cut-off Values.

			NT >1mm		NT >1.5		NT >2		NT >2.5	
Weeks	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
11-11+6	22	22	20	90.9	10	45.3	3	13.6	1	4.5
12-12+6	51	51	40	78.4	18	35.3	6	11.8	1	2.0
13-13+6	27	27	19	70.4	12	44.4	3	11.1	0	0
Total (11-13+6)	100	100	79	79.0	40	40.0	12	12.0	2	2.0

Table 3 shows the distribution of the NT thickness with gestational age according to 1mm, 1.5 mm, 2mm, and 2.5 mm fixed cut off values. In 11–11+6 weeks of gestation, 4.5% of study population has 2.5 mm or greater NT thickness, and then it is 2% in total 11–13+6 weeks of gestation.

Table 4: Results of Previously Reported Studies Estimating Reference Values for Nuchal Translucency in Different Ethnic Origins.

Ethnic Origin	n	GW	CRL Range/ mean (SD)	Mean NT mm (SD)	Median NT mm (SD)	NT 95th per mm n (SD)	NT 97th per. mm	NT 99th per. N (%)	NT >2.5 mm n (%)	NT > 3 mm n (%)	NT > 3.5 mm n (%)
Caucasian	1031	10-14	58.0 (10.3)	1.54 (0.15)	1.02 (0.43)	-	-	-	-	-	-
African	449	10-14	60.0 (10.7)	1.48 (0.49)	0.97 (0.30)						
Asian	232	10-14	61.0 (10.0)	1.61 (0.86)	1.05 (0.55)						
Caribbean	232	10-14	58.9 (9.7)	1.15 (0.92)	0.99 (0.57)						
Thai	4352	10-14	60.2 (9.7)	1.15 (0.38)	1.15-1.85	1.57-2.10					
Asian	879	9-14	51.1 (15.2)	1.72 (0.49)	1.7 (0.5-4.3)	2.32-2.83			53 (6)		
Korean	2577	11-14	60.1 (9.07)	1.62 (0.50)	1.6	2.24-3.03			103 (4)		
Japanese	970	11-14	45-80	1.2-1.9	-	2.10-3.2					
Danish	222 505	11-14	45-84	-	-	1.6	2.8	4.0			
London	20 217	11-14	38-84	-	-	2.32-2.83 917 (5)	-	221 (1)	106 (5)		
Turkish prev.rep	190	11-14	63.63 (10.0)	1.23 (0.43)							
Turkish study	1605	11-14	45-84	1.57 (0.74)		2.82	3.17	4.75	108 (6.6)	66 (4)	36 (2.2)
Central Indian study	100	11-14	45-84	1.43(0.27)	-	2.37	2.53	2.66	2.0	-	-

DISCUSSION

Numerous studies conducted across various regions of the world have highlighted the effectiveness of nuchal translucency (NT) measurement as a valuable screening tool for detecting both chromosomal and non-chromosomal abnormalities.

While most studies have adopted the FMF-recommended definition of nuchal translucency (NT) thickness (typically 2.5–3 mm), more recent research suggests that assessing NT as a continuous variable is more appropriate than relying on a fixed cutoff [7,8].

In this study, we established reference values for nuchal translucency (NT) thickness among pregnant women to determine its normative range and assess the association between increased NT thickness. Our findings indicate that the 95th percentile reference for NT thickness is 2.37 mm. [9,10].

Although previous studies have explored the relationship between increased nuchal translucency (NT) values and adverse pregnancy conditions. conditions such as miscarriage, fetal loss, and other abnormalities, But none of them have established normative NT thickness as well as increased nuchal translucency values . Therefore, the present study aimed to determine both the values of NT thickness among pregnant women to increase awareness among them [11,12].

Our findings revealed that for a crown-rump length (CRL) between 45 mm and 84 mm, the mean NT thickness is 1.43 mm, while the 95th percentile values is 2.37 mm. Based on gestational age (GA), the mean NT measurements at 11-11+6, 12-12+6, and 13–13+6 gestational weeks are 1.30 ± 0.55 mm, 1.50 ± 0.60 mm, and 1.60 ± 0.65 mm, respectively. Correspondingly, the 95th percentile NT values were 2.20mm, 2.40mm, and 2.50 mm for 11, 12, and 13 weeks of gestation, respectively [13].

In populations from Japan, Korea, and Brazil, the median NT thickness for a CRL between 45 mm and 84 mm has been found to range from 1.2–1.9 mm, 1.22–2.10 mm, and 1.19–1.73 mm, respectively. In comparison, the mean NT values observed in our study were close to all the three population [14,15].

The 95th percentile values for nuchal translucency (NT) thickness corresponding to a crown-rump length (CRL) of 45 mm to 84 mm have been reported as follows: 2.1–3.2 mm in Japan, 2.14–2.3 mm in Korea, 1.57–2.10 mm in Brazil, 1.00–2.90 mm in Thailand, and 1.84–2.35 mm in China [16]. Our findings closely aligned with the reference range reported for the Korea & Chinese population.

The variations observed in NT measurements across different studies may be attributed to several factors, including the radiologist's level of experience, the quality of the ultrasound equipment, the measurement technique employed, and suboptimal fetal or nuchal cord positioning [17].

The findings of this study indicate that nuchal translucency (NT) measurement in the first trimester is an effective predictor of high risk for fetal Down syndrome. [18] .

In conclusion overall detection sensitivity in first-trimester scans ranges from ~40%–85%, depending on image quality, protocol detail, and the types of anomalies evaluated.

Early anomaly scan is not a substitute for the standard second-trimester

(18–22 weeks) anatomy scan: many anomalies develop later and might not be visible early. But still, early anomaly scan offers benefits like earlier identification of major anomalies,more time for decision-making, genetic testing, and has potential for safer pregnancy termination when needed.

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