International Journal of Radiology and Diagnostic Imaging

E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2023; 6(2): 35-39
Received: 07-02-2023
Accepted: 20-03-2023

Dr. Raisa Sabu
Radiodiagnosis, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidhyapeeth University, Puducherry, Puducherry Union Territory, Puducherry, India

Dr. Prabhu CS
Professor, Radiodiagnosis, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University, Puducherry, Puducherry Union Territory, Puducherry, India

Dr. Sunil Kumar Samal
Professor, Radiodiagnosis, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University, Puducherry, Puducherry Union Territory, Puducherry, India

Dr. Col Sudhir Sachar
Professor and HOD, Radiodiagnosis, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University, Puducherry, Puducherry Union Territory, Puducherry, India

Corresponding Author:
Dr. Raisa Sabu
Radiodiagnosis, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University, Puducherry, Puducherry Union Territory, India

Normal intracranial translucency values during first trimester gestation in regional south Indian population: Cross sectional study

Dr. Raisa Sabu, Dr. Prabhu CS, Dr. Sunil Kumar Samal and Dr. Col Sudhir Sachar

DOI: http://dx.doi.org/10.33545/26644436.2023.v6.i2a.324

Abstract
Title: Normal intracranial translucency values during first trimester gestation in regional south Indian population: cross sectional study.
Background: Pregnancy is associated with a plethora of changes, which has to be monitored regularly with diagnostics like ultrasound, however the shortcomings of US requires alternatives such as intracranial translucency to detect anatomic malformations in the fetus.

- Estimate the normal reference values of intracranial translucency in the first trimester screening of low risk singleton pregnancy using ultrasonography
- Assess the relation between intracranial translucency & Crown rump length
- Assess the relation between intracranial translucency and Nuchal translucency

Materials and methods: Study was carried out amongst 117 pregnant females between 18-45 years who came for First trimester aneuploidy screening attending MGMCRI, Puducherry.
Results: The maximum no of pregnant women <25 years (47.9%). The mean gestational age was 12.36 weeks {12-12.6 weeks (69.2%)}. The mean crown rump length, intra-cranial translucency and nuchal translucency, wherein the recorded mean values were found to be 6.36, 1.56 & 1.60 respectively. At 11 to 14 weeks of Gestation, the IT was 1.1to 2.5 mm & the CRL increased from 51 to 80 mm with the mean NT values increasing from 1.16 to 2.2.
Conclusion: Our study made it evident that Intracranial Translucency can be easily measured while scanning for NT, which is backed by the positive correlation between the IT measurements against the gestational week and CRL length, with a linear advancement & there exists a positive correlation between NT & CRL, amongst normal singleton pregnancies of south Indian population. Hence, intracranial translucency can be used as an early assessment tool for the diagnosis of any malformations associated with the fetus.

Keywords: Pregnancy, trimester, intra-cranial pressure, ultrasound, nuchal translucency, nasal bone

Introduction

Pregnancy is associated with a plethora of changes, which leads to necessary as well as unnecessary changes in the mother, as per the demands of the fetus. Therefore periodic evaluation of the mother & the fetus is important to determine such changes which can be demanding for the fetus and may also provide the health status of the mother & the child.

Ultrasound has been the conventional diagnostic prenatal care parameter which provides an insight into the health of the fetus during pregnancy. Its non-invasive nature accompanied with a high rate of sensitivity & specificity, which makes it the most favored diagnostic modality during the various stages of pregnancy [1].

Ultrasound is capable of detecting the various fetal abnormalities without any adverse effects, with a high rate of reproducibility of the results on re-evaluation.[1] At the period of 11-14 weeks the periodic scan of the feus determines the health status including the anatomic structural growth as well as its anomalies, apart from aneuploidy markers like nuchal translucency (NT) & nasal bone (NB) [2]. However, the shortcomings of the ultrasound include its inability to consistently diagnose open neural tube defects other than the exencephaly/anencephaly sequence [3]. Hence, there arises a need to develop and use newer diagnostic modalities. Intracranial translucency (IT) is one such sonographic technique by means of which detection of open neural tube defects is possible [4].

Intracranial translucency is the lucid echo space in the fetal nervous system corresponding to fourth ventricle seen behind the brainstem in the mid sagittal plane of fetal face which is the same plane used to measure nuchal translucency and nasal bone in the first trimester [5].

Other than detection of open neural tube defects, changes such as enlargement of the IT can be used for the early detection of cystic malformation of the posterior fossa[6] like Dandy walker syndrome and Blake pouch cyst, whereas obliteration or reduction in thickness of IT is related with open spina bifida [1, 4].

Therefore, it is the need of the hour to use alternatives like intracranial translucency to determine the presence of any anatomic malformations in the fetus

Aims & Objectives

- To estimate the normal reference values of intracranial translucency in the first trimester screening of low risk singleton pregnancy using ultrasonography
- To assess the relation between intracranial translucency & Crown rump length (CRL)
- To assess the relation between intracranial translucency and Nuchal translucency (NT).

Materials & Methods

The study was conducted over a period of 18 months from January 2021 to June 2022 amongst 117 pregnant females between 18-45 years who came for First trimester aneuploidy screening attending MGMCRI, Puducherry.

Inclusion Criteria

- Low risk singleton pregnant females
- Age range of 18-45 years
- First trimester aneuploidy screening

Exclusion criteria

- Artificial reproduction techniques pregnancies
- Babies with congenital anomalies in previous pregnancies.
- Babies with congenital anomalies in present scan.

Procedure

A detailed patient history was recorded after obtaining patient consent in such patients, followed by sonographic examination using Mindray DC 8 or Voluson P8 system. Intracranial translucency was measured in the mid sagittal plane of fetal face, which is seen as a translucent area parallel to nuchal translucency.

Translucency was the widest diameter placing the calipers on the anterior and posterior echogenic borders with normal, obliterated or increased area were recorded. Other recorded parameters were maternal age, number of pregnancies, gestational age at ultrasound exam, CRL, NT.

Data collection

All data was entered into a Data Collection Proforma Sheet (Appendix 1) and was entered into Excel (MS Excel 2019). Other biographical details were also collected including age.

Statistical methods

Statistical analysis included descriptive statistics (mean, standard deviation for quantitative variables, frequency and proportions for qualitative variables), Unpaired `t` test, ANOVA & Pearson's correlation test, with the level of significance set at 5%.

Results

The maximum no of pregnant women <25 years (47.9%), followed by 26-30 years (36.8%) & >30 years (15.4%), with the mean gestational age was 12.36 weeks, with the most common gestational age being 12-12.6 weeks (69.2%), followed by 13-13.6 weeks (23.9%). The majority (65%) of pregnant women had Primi gravida.

At 11 to 14 weeks of Gestation, the IT at first trimester ranged from 1.1to 2.5 mm as the CRL increased from 51 to 80 mm. The mean crown-rump length in our study was 6.36 cm and mean IT was 1.56 mm. NT measurements increased with increasing crown- rump length which showed a statistically significant relationship. As the crown –rump length increased from 51 to 80 mm, mean NT values increased from 1.16 to 2.2.

Nuchal translucency measurements increased significantly with increasing gestational age. The 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 99th percentile values for each of the crown-rump length groups and the overall crown-rump length were established. An intracranial translucency nomogram was generated according to the crown-rump length values. Intracranial translucency was linearly correlated with CRL in our study.

Table 1**:** General Descriptive Statistics of Antenatal Mothers And Fetus

Variables	Minimum	Maximum	Mean	Std. Dev
AGE	19	35	26.11	3.702
GA	11	14	12.36	.579
CRL(cm)	5.15	8.01	6.36	.58
IT(mm)	1.1	2.50	1.56	0.27
NT(mm)	1.16	2.20	1.60	0.21

Table 2**:** Association of Crown Rump Length Vs Intracranial Trnaslucency

CRL	N	Intracranial Translucency		F value*	p value
		Mean	Std. Deviation		
4.5-5.4	4	1.11	0.03	141.2	0.001
5.5-6.4	61	1.37	0.15		
6.5-7.4	48	1.78	0.06		
> 7.4	4	2.2	0.29		
Total	117	1.62	0.49		

Table 3: Association of Crown Rump Length Vs Nuchal Translucency

CRL	N	Nuchal Translucency		F value*	p value
		Mean	Std. Deviation		
4.5-5.4	4	1.20	0.02	131.7	0.001
5.5-6.4	61	1.46	0.10		
6.5-7.4	48	1.77	0.11		
> 7.4	4	2.07	0.10		
Total	117	1.60	0.21		

Table 4**:** Pearson Correlation

Pearson correlation	IT (mm) with	
	AGE	NT(mm)
r value	0.076	0.937
p value	0.415	0.001
N	117	117

Table 4: Intracranial Translucency Normogram

Percentile									
CRL (in mm)	**1**	**5**	**10**	**25**	**50**	**75**	**90**	**95**	**99**
52	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
54	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
55	1.14	1.14	1.14	1.16	1.17	1.20			
56	1.12	1.12	1.12	1.14	1.18	1.18			
57	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
58	1.19	1.19	1.19	1.20	1.22	1.30			
59	1.20	1.20	1.20	1.23	1.32	1.39			
60	1.10	1.10	1.12	1.35	1.40	1.49	1.50		
61	1.30	1.30	1.30	1.47	1.49	1.52			
62	1.36	1.36	1.36	1.45	1.53	1.56			
63	1.48	1.48	1.48	1.50	1.54	1.58			
64	1.50	1.50	1.50	1.50	1.55	1.60			
65	1.70	1.70	1.70	1.70	1.74	1.74			
66	1.68	1.68	1.69	1.76	1.76	1.76	1.76		
67	1.18	1.18	1.18	1.57	1.74	1.78			
68	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
69	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
70	1.48	1.48	1.48	1.48	1.63				
71	1.34	1.34	1.34	1.57	1.80	1.81			
72	1.85	1.85	1.85	1.85	1.88				
73	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
74	1.90	1.90	1.90	1.90	1.90	1.92			
75	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
78	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
80	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50

Fig 1-3: Mid Sagital plane showing IT and NT values

Discussion

Prenatal diagnostic visits are performed with aim to diagnose any fetal malformations or any aneuploidies which may affect the fetus and increase the risk of malformations. During the first trimester, these tests are usually carried out in the period of 11-14 weeks, wherein it is possible to identify signs of fetal malformations and various markers of aneuploidy [4, 7, 8]. However, the chances of missing some of the open neural defects by ultrasound diagnostic test alone are high and hence the requirement of an alternative diagnostic test such as intracranial translucency test is essential in diagnosing CNS defects [9, 10, 11, 12].

In our study amongst 117 singleton pregnancies, we assessed the gestational age, crown rump length, intra-cranial translucency and nuchal translucency, wherein the recorded mean values were 12.36, 6.36, 1.56 & 1.60 respectively.

The Intracranial translucency (fourth ventricle) was recorded as a translucent area which is parallel to nuchal translucency & is capable of detecting open neural defects. Herein, the ant border was corresponding to the post edge of the brainstem as well as the post border to the ant aspect of choroid plexus (fourth ventricle) [13].

The mean gestational age of our patients was 12.36 weeks, with the most common gestational age range being 12-12.6 weeks (69.2%), followed by 13-13.6 weeks (23.9%).

We used the criteria stated by Chaoui *et al.*, [1] by placing the calipers on the anterior & posterior echogenic borders to evaluate the intracranial translucency wherein we recorded it to be in the range of 1.1 – 2.5 (min – max), with the mean value being 1.56.

We found a definite correlation between the intracranial translucency and the crown rump length wherein there was an increase in the intracranial translucency in proportion with the crown-rump length, which was in agreement with the study done by Molina-Geraldo *et al.* [5], Further, the Pearson correlation test results among these two parameters showed a definite positive correlation (p -0.001), which was also observed by Molina-Geraldo *et al.*, [5] (less significant than our study results). However, their study consisted of 1520 Latin American subjects who belonged to different ethnicity.

We also found that at the period of 11 to 14 weeks of Gestation, the intracranial translucency during the first trimester ranged from 1.1 to 2.5 mm with an analogous increase in the CRL from 51 to 80 mm. Similar results were reported by Chaoui *et al.* [7], amongst the Caucasians, wherein they recorded an increase in the IT from 1.5 to 2.5

mm at the same gestation period.

The intracranial translucency levels in our study was recorded in the range of 1.1 – 2.5 (min – max), whereas it was slightly higher in the study done by Chen *et al*., [14] who found it to be in the range from 1.35 to 2.6mm amongst the Chinese population.

The 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 99th percentile values for each of the crown-rump length groups and the overall crown-rump length were established. An intracranial translucency nomogram was generated according to the crown-rump length values. Intracranial translucency was linearly correlated with CRL in our study. This was similar to the nomogram generated for Latin American population by Molina-Geraldo *et al*. [5],

Our study results were in agreement with the previous studies wherein the NT measurement increased with the increase in the crown- rump length, which was found to be statistically significant (p- 0.001) [15].

We observed that with the increase in the crown –rump length from 51 to 80 mm was proportionate to the increase in the mean NT values from 1.16 to 2.2. Abnormal increase in NT is associated with aneuploidy. This was similar to what was observed by Jou *et al*., [15] on their study on 879 fetuses in Asian population.

Literature studies show that Nuchal translucency measurements increased significantly with increasing gestational age, with our study showing similar results & further congregating to the existing evidence.

However, it is suggested that the reference ranges of nuchal translucency measurements with gestation, should be used to screen for chromosomal abnormalities [16].

The mean gestational age in our study population was 12.3 weeks with an NT range of 1.16mm to 2.2 mm & we also found a positive correlation between fetal NT thickness and gestational age, which was in agreement with the study done by Jou *et al*., amongst Asians (69)

The limitations of our study included the inability to estimate inter-observer and intra-observer variability in intracranial translucency values and the non-assessment of perinatal outcomes.

From our study results, we recommend early assessment of intracranial translucency via the Mid-sagittal plane routinely used for measurement of nuchal translucency and assessment of nasal bone, which will allow early detection of spina-bifida.

However, we suggest the usage of intra-cranial translucency in the range obtained from their respective ethnicities, to reduce the disparities in the values which may creep in and also encourage more studies to ascertain the reference range.

Conclusion

Our study made it evident that Intracranial Translucency can be easily measured while scanning for NT, which is backed by the positive correlation between the IT measurements against the gestational week and CRL length. We also found that intracranial translucency increases linearly with advancing CRL & there exists a positive correlation between NT & CRL, amongst normal singleton pregnancies of south Indian population. Hence, intracranial translucency can be used as an early assessment tool for the diagnosis of any malformations associated with the fetus.

References

1. Chaoui R, Benoit B, Mitkowska-Wozniak H, Heling KS, Nicolaides KH. Assessment of intracranial translucency (IT) in the detection of spina bifida at the 11–13-week scan. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2009;34(3):249-52.
2. Kavalakis I, Souka AP, Pilalis A, Papastefanou I, Kassanos D. Assessment of the posterior brain at 11–14 weeks for the prediction of open neural tube defects. Prenatal diagnosis. 2012;32(12):1143-6.
3. Papastefanou I, Souka AP, Pilalis A, Panagopoulos P, Kassanos D. Fetal intracranial translucency and cisterna magna at 11 to 14 weeks: reference ranges and correlation with chromosomal abnormalities. Prenatal diagnosis. 2011;31(12):1189-92.
4. Chaoui R, Nicolaides KH. From nuchal translucency to intracranial translucency: towards the early detection of spina bifida. Ultrasound in Obstetrics and Gynecology. 2010;35(2):133.
5. Molina-Giraldo S, Pérez-Olivo JL, Arias JL, Acuña E, Alfonso D, Arreaza M. Normal intracranial translucency values during the first trimester of gestation in a Latin American population. Journal of Ultrasound in Medicine . 2016;35(10):2231-6.
6. Lafouge A, Gorincour G, Desbriere R, Quarello E. Prenatal diagnosis of Blake's pouch cyst following first-trimester observation of enlarged intracranial translucency. Ultrasound in Obstetrics & Gynecology. 2012;40(4):479-80.
7. Chaoui R, Nicolaides KH. Detecting open spina bifida at the 11-13-week scan by assessing intracranial translucency and the posterior brain region: mid-sagittal or axial plane? Ultrasound Obstet Gynecol Off J Int Soc Ultrasound Obstet Gynecol. 2011;38(6):609–12
8. Fong KW, Dengler J, Toi A, Menezes RJ, Karimzad Y, Okun N. Prospective study of intracranial translucency and the posterior brain in normal fetuses at the 11- to 13-week scan. J Ultrasound Med Off J Am Inst Ultrasound Med. 2014;33(8):1373–9.
9. Ergin RN, Yayla M. The nomogram of intracranial translucency in the first trimester in singletons. J Turk Ger Gynecol Assoc. 2012;13(3):153
10. Monteagudo A, Timor-Tritsch IE. Normal sonographic development of the central nervous system from the second trimester onwards using 2D, 3D and transvaginal sonography. Prenat Diagn. 2009;29(4):326–39.
11. Cuckle H. Monitoring quality control of nuchal translucency. Clin Lab Med. 2010;30(3):593–604.
12. Haddow JE, Palomaki GE, Knight GJ, Williams J, Miller WA, Johnson A. Screening of maternal serum for fetal Down's syndrome in the first trimester. N Engl J Med. 1998;338(14):955–962.
13. Buitrago-Leal M, Molina-Giraldo S. [Use of intracranial translucency measurement in first trimester, beyond spina bifida]. Ginecol Obstet Mex. 2014;82(4):236–45.
14. Chen M, Chen H, Yang X, Wang HF, Yeung Leung T, Singh Sahota D, *et al*. Normal range of intracranial translucency (IT) assessed by three-dimensional ultrasound at 11+ 0 to 13+ 6 weeks in a Chinese population. J Matern Fetal Neonatal Med. 2012;25(5):489–492.
15. Jou HJ, Wu SC, Li TC, Hsu HC, Tzeng CY, Hsieh FJ.

Relationship between fetal nuchal translucency and crown-rump length in an Asian population. Ultrasound Obstet Gynecol Off J Int Soc Ultrasound Obstet Gynecol. 2001;17(2):111–4.
16. Braithwaite JM, Morris RW, Economides DL. Nuchal translucency measurements: frequency distribution and changes with gestation in a general population. Br J Obstet Gynaecol. 1996;103(12):1201–4.

How to Cite This Article
S Raisa, CS Prabhu, SK Sunil, SC Sudhir. Normal intracranial translucency values during first trimester gestation in regional south Indian population: Cross sectional study. International Journal of Radiology and Diagnostic Imaging. 2023;6(2):35-39.