



ORIGINAL RESEARCH PAPER

Radiodiagnosis

MEASUREMENT OF FETAL NASAL BONE LENGTH BETWEEN 11 TO 15 WEEKS OF GESTATIONAL AGE AND ITS CORRELATION WITH FETAL OUTCOME

KEY WORDS: Nasal Bone, Fetal Outcome, Gestational Age, Indian Fetuses

Dr. Apoorva Dixit	Resident, Department Of Radiodiagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha
Dr. Bikash Parida*	Assistant Professor, Department Of Radiodiagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha *Corresponding Author
Dr. S.S.G. Mohapatra	Head of Department, Department Of Radiodiagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha
Dr. Niranjana Sahu	Professor, Department Of Radiodiagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha
Dr. Kapse Pratik Siddheshwar	Resident, Department Of Radiodiagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha

ABSTRACT The aim of this study to establish the reference range of fetal nasal bone length (NBL) of Indian fetuses between 11 to 15 weeks of gestational age and to study its correlation with fetal outcome. This study presents the normal range of fetal Nasal bone length in fetus between 11 to 15 weeks of gestational age. The fetal NBL was measured in millimetres in a strict sagittal view of the fetal head. The NBL appears to be marginally shorter in Indian fetuses than in other fetuses. This indicates that the normal range would vary among races so while considering the measurement a relative percentile is a more reliable screening criterion than an absolute value.

INTRODUCTION:

Nasal bone is an important fetal structure to be evaluated during the first and second trimesters of pregnancy. It begins its development at around the 6th week of gestation and is first visualized on ultrasound at 11 weeks of gestation or 42mm of crown-rump length (CRL).^[1,2,3]

Nomograms of nasal bone length have been in use in obstetric ultrasound for ruling out a number of fetal chromosomal aneuploidies. This relationship between the nasal bone length and fetal chromosomal aneuploidy stands the strongest in the case of Down syndrome, which, in turn, is the most common chromosomal aneuploidy found amongst the live births^[2].

The morphometrics of the nasal bone, however, differs with ethnicity^[1]. A normal reference range for fetal nasal bone length has been established for the Caucasian, Afro-American and South American populations^[1,4,5,6,7,8] but such data is at best scanty with reference to the subcontinent^[1]. As the facial symmetry varies widely with ethnicity, the existing reference nasal bone lengths for populations in other continents may induce misinterpretation of normal Indian fetuses as possible aneuploid. Therefore, if this marker has to be applied for routine screening in the subcontinent, it is critical that a normal nasal bone length reference be established.

MATERIALS & METHODS:

The study included 104 antenatal women referred to Department of Radiology of IMS & SUM HOSPITAL, Bhubaneswar. The study was conducted for a period of 1 Years (August 2017 to August 2018). Inclusion criteria consist of normal antenatal women of gestational age between 11 to 15 weeks. Those affected with physical and mechanical conditions which limit a proper view of fetal nasal bone like Maternal obesity, Oligohydramnios, Fetal presentations incompatible with obtaining a mid-sagittal view of the fetal face were excluded. The gray scale real time ultrasonographic examination were performed using Samsung Accuvix A30, Samsung HS70A &

GE Voluson E6 USG Machine. The transducers used were 2.5 MHz convex array.

METHODOLOGY:

Before the scan an informed written consent was taken from all participants who fit into the inclusion criteria. A detailed clinical history was taken and ultrasonography findings were recorded in a pre-designed proforma. NBL measurements were taken in mid sagittal view.

“THE MID-SAGITTAL VIEW OF THE FETAL FACE IS DEFINED AS:

- Presence of the echogenic tip the nose and rectangular shape of the palate anteriorly.
- The translucent diencephalon in the center.
- The nuchal membrane posteriorly.

Deviations from the exact midline plane result in non-visualization of the tip of the nose and visibility of the zygomatic process of the maxilla and subsequently wrong assessment^{”[1]}.

USG was performed with the pregnant mother lying supine. Trans-abdominal sonogram was performed by placing the transducer over the gravid uterus. Measurement of the fetal nasal bone was performed via a mid-sagittal view of the fetal head. The maximum length was measured in millimetres. Patient was followed up till delivery to record fetal outcome.

THE SCAN WAS USED TO EVALUATE THE FOLLOWING:

- Length of the fetal nasal bone in millimeters.
- Crown-rump length in millimeters and in terms of gestational age (up to 14 weeks).
- Biparietal diameter in millimeters and in terms of gestational age.
- Head circumference in millimeters and in terms of gestational age.
- Abdominal circumference in millimeters and in terms of gestational age.
- Femur length in millimeters and in terms of gestational age.

- Patients were followed up to record fetal outcome.

STATISTICAL ANALYSIS:

The imaging findings were recorded on an excel sheet, and then imported to Stata v 12.1 SE for analysis. Data were analysed and interpreted in the following aspects:

- Fetal nasal bone length (continuous variable) was presented as mean ± SD and median. Presence or absence of syndrome/congenital anomaly if any (categorical variable) were presented in number and percentage (%).
- Percentiles of fetal NBL were calculated for different gestational weeks, and 5% levels were taken as lower cut off to demarcate fetal nasal bone hypoplasia.

RESULTS & DISCUSSION:

In the sixth week of gestation NB starts its development as collections of neural crest cells and become ossified through the process of intramembranous ossification [1]. The nasal bone may be visualized on the mid-sagittal sonogram of the face after the tenth week of pregnancy and consists of two separate bones. The nasal bones first appear at a crown rump length (CRL) of 42 mm (11 weeks) as shown by histological and radiological studies of aborted foetuses [12]. NBL is an objective measurement, presence or absence of nasal bone holds significant importance in clinical practice.

In our study group of 104 patients, age ranging from 18 to 36 years with the mean age of be 25.14 with the standard deviation of 3.12 years were evaluated, successful measurement of NB was achieved in all cases and fetal outcome was normal in all cases. The cut-off values for nasal bone length at various estimated gestational weeks has been summarized in table 1.

Table 1: Distribution of nasal bone length (in mm) as per gestational age (in wks.) (n=104)

Various percentiles of nasal bone length (in mm)								
EGA	N	5	10	25	50	75	90	95
11-11+6	10	1.6	1.75	2.2	2.6	2.8	3.0	3.0
12-12+6	17	1.9	2.0	2.3	2.8	3.0	3.8	4.0
13-13+6	49	1.9	2.3	2.6	3.0	3.2	3.6	3.8
14-14+6	15	2.8	2.9	3.0	3.1	3.25	3.4	4.0
15-15+6	13	2.9	2.9	3.2	3.3	3.7	4.0	4.2

Table 4: 50th & 5th percentile NBL in different ethnic groups

Wks.	50 th percentile bone length (mm)				5 th percentile bone length (mm)			
	Budunki et. al	Chen et. al.	Kangawa et. al.	Current study	Budunki et. Al	Chen et. al.	Kangawa et. al.	Current study
15	ND	3.5	3.2	3.3	ND	3.2	2.7	2.9

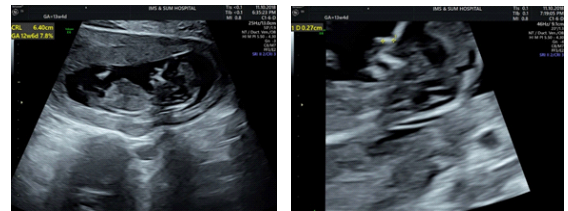
The NBL appears to be marginally shorter in Indian fetuses than in other fetuses. This indicates that the normal range would vary among races. This study shows that the ethnicity of the mother affects the normal range of fetal NBL.

It is inferred that, the current study showed no significant statistical difference between east-indian population and rest of indian population.

GA (weeks)	NBL at 50 th percentile from various studies in indian population		
	Prabha et al	Jain et al	Present study
11	2.85	ND	2.6
12	3.1	ND	2.8
13	3.2	ND	3.0
14	ND	2.9	3.1
15	ND	3.2	3.3

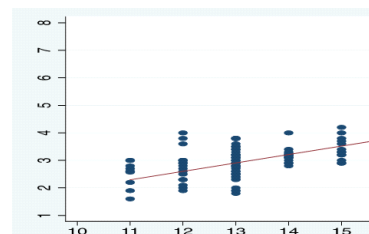
CONCLUSIONS

There exists a linear positive correlation between fetal Nasal bone length and the estimated gestational age. Instead of only commenting on presence or absence of nasal bone NBL



1a CRL **1b Nasal bone length**
Fig 1: Representative Case

In our study, fetal nasal bone length was measured between 11 to 15 weeks of gestation and to reduce the interobserver variation, the average of findings by two radiologists with an experience of at least 2 years was taken into consideration. Previous literature has concluded that nasal bones show a linear growth that parallels that of other bones. Odibo and colleagues reported that nasal bone size showed a linear increase between the 11th and 20th gestational weeks [13]. "Guis et al established a nasal bone growth curve in a series of 376 fetuses with no abnormalities between 14 and 35 weeks gestation". An increase in NBL with advancing gestational age was seen by these authors, which is comparable to our results as well as with others in the literature [6].



EGABYUSG

Fig 2: Nasal bone length growth at various gestational ages

This study also affirmed that there are noteworthy contrasts in the median fifth percentile nasal bone lengths between white, African American, Thai population, Japanese population and our Indian population which can be seen in the below mentioned table.

length measurement can be incorporated in the routine anomaly scans to rule out fetal aneuploidies and their outcomes. However larger study population is required to firmly establish the normal reference range and cut-off values.

REFERENCES

1. Kashikar SV, Lakhkar BN. Assessment of Fetal Nasal Bone Length and Nasofrontal Angle in the Second Trimester in Normal Indian Pregnancies. J Fetal Med 2014;1:137-141.
2. Bromley B, Liberman E, Shipp DS, Benacerraf R. Fetal Nose Bone Length A Marker for Down Syndrome in the Second Trimester. J Ultrasound Med 2002; 21:1387-1394.
3. Cicero S, Crucio P, Papageorgiou A, Sonek J, Nicolaides K. Absence of nasal bone in fetuses with trisomy 21 at 11-14 weeks of gestation: an observational study. The Lancet 2001;358:1665-67.
4. Guis F, Ville Y, Vincent Y, Doumerc S, Pons JC, Frydman R. Ultrasound evaluation of the length of the fetal nasal bones throughout gestation. Ultrasound Obstet Gynecol 1995; 5:304-307.
5. Gamez F, Ferreiro P, Salmean JM. Ultrasonographic measurement of fetal nasal bone in a low-risk population at 19-22 gestational weeks. Ultrasound Obstet Gynecol 2004; 23:152-153.
6. Sonek JD, McKenna D, Webb D, Croom C, Nicolaides K. Nasal bone length throughout gestation: normal ranges based on 3537 fetal ultrasound measurements. Ultrasound Obstet Gynecol 2003; 21:152-155.
7. Bunduki V, Ruano R, Miguez J, Yoshizaki CT, Kahhale S, Zugaib M. Fetal nasal bone length: reference range and clinical application in ultrasound

- screening for trisomy 21. *Ultrasound Obstet Gynecol* 2003;21:156-160.
8. Zelop CM, Milewski E, Brault K, Benn P, Borgida AF, Egan JF. Variation of fetal nasal bone length in second-trimester fetuses according to race and ethnicity. *J Ultrasound Med* 2005;24(11):1487-9.
 9. Narayani BH, Radhakrishnan P. Mid-second Trimester Measurement of Nasal Bone Length in the Indian Population. *J Obstet Gynaecol India* 2013;63(4):256-259.
 10. Sivri D, Dane C, Dane B, Cetin A, Yayla M. Normogram of fetal nasal bone length at 11-13+6 gestational weeks in fetuses. *Perinatal Journal* 2006;14:122-128.
 11. Luchi, C., Persico, N., Rembouskos, G. and Nicolaides, K. H. (2014), Practical approach to obtain the mid-sagittal plane of the fetal face at 11-13 weeks' gestation by two-dimensional ultrasound. *Ultrasound Obstet Gynecol*, 44: 617-618. doi:10.1002/uog.14660.
 12. Sandikcioglu M, Molsted K, Kjaer I. The prenatal development of the human nasal and vomer bones. *J Craniofac Genet Dev Biol*. 1994;14:124-34.
 13. Odibo AO, Sehdev HM, Dunn L, McDonald R, Macones GA. The association between fetal nasal bone hypoplasia and aneuploidy. *Obstet Gynecol*. 2004;104:1229-33.
 14. Chen M, Lee C, Tang R. First-trimester examination of fetal nasal bone. *Prenat Diagn*. 2006;26:703-6.
 15. Jain S, Khanduri S, Khan M, Khan S, Yadav VK, Khan BR, et al. Mid-second trimester measurement of nasal bone length in North Indian population. *J Clin Imaging Sci* 2019;9:14.