

Nomogram of Nasal Bone Length in Euploid Fetus at 18-22 Weeks of Gestation in Bangladeshi Population

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Abstract

Introduction: Down syndrome (DS) is the most common chromosomal aneuploidy to result in a live birth. Prenatal diagnosis of the affected fetuses can be performed using variety of sonographic features. Within the 11 to 14 weeks gestational age (GA) window, increased nuchal translucency has been the hallmark for identifying fetuses with Down syndrome.

Objective: To estimate the Nasal Bone Length (NBL) of fetuses at 18 to 22 weeks GA in Bangladeshi population and establish the Nomogram of it and finally compare it with that of Caucasian population.

Materials and Methods: The prospective observational study was conducted in Aklima General Hospital Limited, Mirpur, Dhaka, Bangladesh in the Feto-maternal Medicine Unit under Obstetrics and Gynaecology Department for tenure from February 2014 to June 2019. After considering the inclusion and exclusion criteria, 500 antenatal subjects married to Bangladeshi partners with singleton pregnancies attending the routine antenatal outpatient department for an anomaly scan (18-22 weeks) were included and followed up in the study. The nasal bone length was measured from the base of the nose closest to the frontal bones to the farthest extent of ossification on the nose.

Results: The nasal bone lengths of the fetuses at 18 to 22 weeks were measured in 500 cases where for 19 cases of 18 weeks of GA fetuses have a mean NBL of 4.6 mm, 75 cases of 19 weeks of GA fetuses have a mean NBL of 4.8 mm, 161 cases of 20 weeks of GA fetuses have a mean NBL of 5.1 mm, 169 cases of 22 weeks of GA fetuses have mean NBL of 5.8 mm and 76 cases of 22 weeks of GA fetuses have mean NBL of 6.2 mm which is significantly shorter than those of Caucasian population.

Conclusion: The nasal bone lengths of the fetuses at 18 to 22 weeks were significantly shorter to those of the Caucasian population.

Introduction

Increased nuchal translucency and absent nasal bone are now an established aneuploidy marker for Down syndrome. Other first trimester aneuploidy markers include abnormal flow velocity patterns in the Ductus Venosus, Maxillary Hypoplasia, Fronto-Maxillary Facial (FMF) angle and Tricuspid Regurgitation¹.

Additional parameters that have been received attention in literature and used by some groups include maxillary length, ear length, megacystis, flat iliac wings, and early onset growth restriction. Between 15 to 20 weeks GA (2nd trimester), identification of aneuploid fetuses are dependent mainly on sonographic markers such as a thickened nuchal skin fold, long-bone length, pyelectesis, echogenic intra-cardiac foci, and hyper-echoic bowel. The sonographic identification of these features has allowed the detection of 60% to 80% of fetuses with Down syndrome, with false-positive rates of 5% to 15%^{2,3}.

Nasal Bone Length (NBL) has been described as a marker for Trisomy21 (T21) at 15 to 22 weeks of GA with a likelihood ratio of 50 to 83 if it is absent or hypoplastic^{4,5}, as cited by Sharma et al⁶. Nasal bone hypoplasia detects Down syndrome (DS) with a sensitivity of 60% at a false positive rate (FPR) of 1-5%, making it as sensitive as the maternal serum biochemistry in detecting DS in the second trimester^{6,7}.

The fetal nasal bone length in Chinese population appeared shorter than that of Caucasian and African-Americans^{8,9}. NBL in Thai fetuses at 11 to 19 weeks GA was found to be on average shorter than that in Caucasian, African-American and Chinese populations, but similar to those reported in Korean and Latin-American populations¹⁰. The Nasal bone length appears to be shorter in Korean fetuses than Caucasian and Chinese fetuses¹¹. It is found in different studies that nasal bone length in Japanese population was significantly shorter and biparietal diameter / Nasal bone length was significantly greater than those in the Caucasian and black populations¹².

In this study, it was tried to evaluate the normal length of nasal bones in fetuses of 18 to 22 weeks GA and to establish its normal range in a set of population of Bangladesh by using 2D Ultrasonography and compare it with that of Caucasian population.

Materials and Methods

The prospective observational study was conducted in Aklima General Hospital Limited, Mirpur, Dhaka, Bangladesh in the Feto-maternal Medicine Unit under Obstetrics and Gynaecology Department for tenure from February 2014 to June 2019. After considering the inclusion and exclusion criteria, 500 antenatal subjects married to Bangladeshi partners with singleton

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pregnancies attending the routine antenatal outpatient department for an anomaly scan (18-22 weeks) were included and followed up in the study. Considering 95% confidence level a sample population of 500 was considered.

Patients with excellent dates or dating scan, singleton pregnancies, and pregnant women of age 17-35 years, GA second trimester (18-22 weeks) willing to get enrolled were included. Pregnant women of age <17 years or >35 years, multiple gestations, previous history of chromosomal abnormality, referral because of suspected fetal abnormality by previous ultrasound, presence of structural abnormality in fetus were excluded.

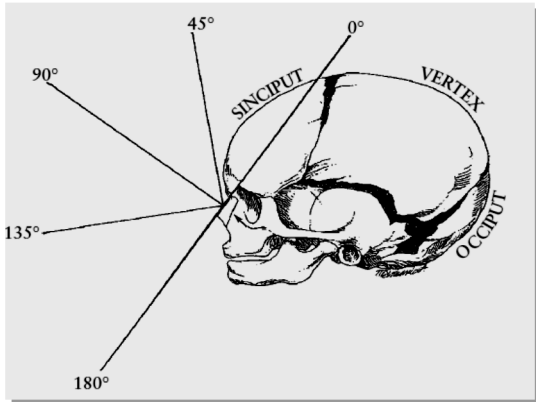


Figure-1: Fetal Skull

A diagrammatic Representation of the Fetal Skull: The ideal angle of insinuation for the measurement¹³ of the upper edge of the nasal bone approaches at 45° or 135°.

Results

According to this study, mean NBL of male fetuses for GA of 18 to <19, 19 to <20, 20 to <21, 21 to <22 and 22 to <23 weeks were 4.5 mm, 4.8 mm, 5.2 mm, 5.8 mm and 6.6 mm respectively. Similarly, mean NBL of female fetuses for GA of 18 to <19, 19 to <20, 20 to <21, 21 to <22 and 22 to <23 weeks were 4.6 mm, 4.8mm, 5.1 mm, 5.8 mm and 6.2 mm respectively (Table-I).

There was no statistical significant difference in mean NBL in male and female fetuses at 18 to 21 weeks were observed, however, there was significant difference ($p < .05$) seen at the 22 weeks with male fetuses' NBL being slightly more compared to the female fetuses' NBL. Correlation analysis found significant correlation between GA and mean NBL ($r=+0.626$, $p < 0.001$). Regression analysis between NBL and GA found the R-Square value 0.392. It suggests that 39.2% of the variation of the NBL values can be explained by GA variation. The regression equation has been derived which can help determine the Reference Value of NBL (dependent variable) with the help of given value of GA (independent variable) for Bangladeshi Population. $[NBL = - 6.329 + (0.5708 \times GA)]$ (Figure-2).

Table-I: Distribution of fetuses of both sexes with different GA and their mean NBL in mm (n = 500)

GA (weeks)	Male Fetus		Female Fetus		Total			
	No	Mean NBL	No	Mean NBL	n (%)	Mean ± SD NBL	Range	Median
18 - <19	10	4.5	9	4.6	19(3.8)	4.5±0.7	3.1-5.8	4.5
19 - <20	41	4.8	34	4.8	75(15.0)	4.8±0.8	2.9-4.6	4.8
20 - <21	84	5.2	77	5.1	161(32.2)	5.2±0.7	3-6.6	5.3
21 - <22	96	5.8	73	5.8	169(33.8)	5.8±5.8	3.1-7.1	5.8
22 - <23	40	6.6	36	6.2	76(15.2)	6.4±6.5	4.4-7.9	6.5

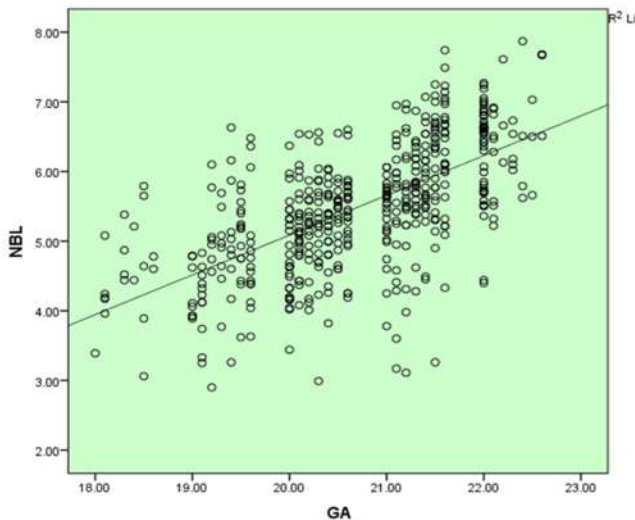


Figure-2: Scatter plot of GA Vs Mean NBL (F = 321.7, $p < .001$).

Discussion

In order to reliably associate data with any particular type of individual, it has become necessary that effective normal values for each population have to be calculated and published. Several studies have been conducted to assess the fetal nasal bone in the different population of different countries. This data can help estimating the normal range in the particular population to prevent any false positive or false negative diagnosis. Hence by studying the values of nasal bone lengths in the fetuses of Bangladeshi population, the values closely correlated with a similar study conducted by Sharma et al⁶ which comprised of both Indian and Bangladeshi population.

Caucasian population has an average NBL of 5.5 mm to 8.3 mm for the fetuses at 18 to 22 weeks of GA¹³⁻¹⁵. This statement summarizes that nasal bone lengths of the fetuses at 18 to 22

weeks were significantly shorter to those of the Caucasian population. Regarding this Langdon Down published a paper entitled "Observations on the Ethnic Classification of Idiots"¹⁶. Guis et al², Cicero et al³, Bromley et al⁴ all they worked with the similar study. Sonek J et al⁸ generated normal nasal bone length reference ranges throughout gestation using prenatal measurements by a standardized technique in 3537 fetuses. No statistical difference was found between African-American and Caucasian subjects^{7,9}. Sonek et al⁸, Suchin et al⁹, Eui et al¹⁰, Kanagawa T et al¹¹, Mogra R et al¹⁴, Persico N et al¹⁵, did the study for different population of the world and support the findings of the present study.

Conclusion

We have found that nasal bone lengths of the fetuses at 18 to 22 weeks of GA for Bangladeshi population is significantly shorter compared to those of Caucasian population and this is really an important observation. Because, based on this study we can reduce number of invasive tests for hypo-plastic nasal bone thereby averting a remarkable number of unnecessary interventions and miscarriage as well as unnecessary parental dilemma and anxiety.

References

1. Romero R, Jeanty P, Hobbins JC. Diagnostic ultrasound in the first trimester of pregnancy. *Clin Obstet Gynecol.* 1984; 27:286–313.
2. Guis F, Ville Y, Doumerc S et al. Ultrasound evaluation of the length of the fetal nasal bones throughout gestation. *Ultrasound Obstet Gynecol.* 1995; 5:304-7.
3. Cicero S, Curcio P, Papageorgiou A et al. Absence of nasal bone in fetuses with trisomy 21 at 11-14 weeks' gestation: An observational study. *Lancet.* 2001; 358:1665-7.
4. Bromley B, Lieberman E, Shipp T et al. Fetal Nasal Bone Length: a marker for Down syndrome in the second trimester. *J Ultrasound Med.* 2002; 21:1387-94.
5. Cicero S, Sonek JD, McKenna D et al. Nasal bone hypoplasia in trisomy 21 at 15-22 weeks' gestation *Ultrasound Obstet Gynecol.* 2003; 21:15-8.
6. Sharma A, Tayal T, Bh N et al. Evaluation of the reference values for the fetal nasal bone length at 16 to 25 weeks of gestational age in an Indian population *Prenat Diagn.* 2013; 33(8):800-3.
7. Bunduki V, Ruano R, Miguez J et al. Fetal nasal bone length: Reference range and clinical application ultrasound screening for trisomy 21. *Ultrasound Obstet Gynecol.* 2003; 21:156-60.
8. Sonek J, McKenna D, Webb D et al. Nasal bone length throughout gestation: normal ranges based on 3537 fetal ultrasound measurements. *Ultrasound Obstet Gynecol.* 2003; 21:152-5.
9. Suchin S, Thitima S, Chitkasaem S et al. A Thai reference for normal fetal nasal bone length at 15 to 23 weeks' gestation. *J Ultrasound Med.* 2009; 28(1):49-53.
10. Eui J, Hye-Sung W, Pil RL et al. Ultrasonographic measurement of fetal nasal bone length in the second trimester in Korean population. *Prenat Diagn.* 2007; 27(2):154-7.
11. Kanagawa T, Fukuda H, Kinugasa Y et al. Mid-second trimester measurement of fetal nasal bone length in the Japanese population. *J Obstet Gynecol Res.* 2006; 32(4):403-7.
12. O'Brien W, Cefalo R. Labor and delivery, in *Obstetrics Normal and Problem Pregnancies* (3rd Edn), Gabbe S, Niebyl J, Simpson J (Eds), New York, NY: Churchill Livingstone, 1996:393.
13. Altunkeser A, Körez MK. Reference ranges for foetal nasal bone length, prenasal thickness, and interocular distance at 18 to 24 weeks' gestation in low-risk pregnancies. *BMC Pregnancy Childbirth.* 2017 Dec 12; 17(1):416.
14. Mogra R, Schluter PJ, Ogle RF et al. A prospective cross-sectional study to define racial variation in fetal nasal bone length through ultrasound assessment at 18-20 weeks' gestation. *Aust N Z J Obstet Gynaecol.* 2010; 50(6):528-33.
15. Persico N, Molina F, Borenstein M et al. Nasal bone length in euploid fetuses at 16-24 weeks' gestation by three dimensional Ultrasound. *Ultrasound Obstet Gynecol.* 2010; 36(3):285-90.
16. Down JHL. Observations on an Ethnic Classification of Idiots, *Clinical lectures and reports by the medical and surgical staff of the London Hospital,* 1866; 3:259-62.