Original Research Article

GESTATIONAL AGE DETERMINATION IN NEWBORNS USING ANTHROPOMETRIC PARAMETERS: A CROSS-SECTIONAL STUDY

Pradip Bamaniya[1], Rutvik Parikh[2], Munjal Kapadia[3]

[1]*Resident, Department of Pediatrics, GCS Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.*
[2]*Associate Professor, Department of Pediatrics, GCS Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.*
[3]*Senior Resident, Department of Pediatrics, GCS Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.*

ABSTRACT

Background: The accurate estimation of gestational age is crucial in identifying prematurity and other health problems in newborns and in providing appropriate perinatal care. Although there are numerous methods for measuring gestational age, they are not always applicable. The main purpose of this study was to design a simple method in assessment of gestational age in rural health centre done by low skilled personnel in low resource setting by using anthropometric parameters.

Material and Methods: This cross sectional observational study was carried out in 200 babies born in Department of Pediatrics Tertiary Care Teaching Institute of India for the duration of 1 year. The data were collected using semi-structured questionnaire and anthropometric assessment.

Results: The mean gestational age among neonates studied is 37.10±2.45 weeks, around 3% were early preterm, 6% were moderate preterm, 22% were late preterm and 68% were term. The mean birth weight is 2.60±0.51 kg in our study, the mean head circumference is 33.80±1.10 cm, and majority of them babies had head circumference 33 cm (Table 2). The mean chest circumference is 31.01±1.25 cm, and majority of the babies, had chest circumference of 30 cm and above, the mean foot length is 7.40±0.50 cm and the mean length of the babies is 48.24 ±1.30.

Conclusion: Anthropometeric parameters in combination and as single parameters were a simple and easy tool for assessing gestational age in low resource setting where we can make a quick referral. Analyzing anthropometric measures after delivery allows a quick assessment of infants with unusual growth more vulnerable to metabolic complications.

Keywords: Anthropometeric Parameters, Gestational Age, Neonates, Preterm.

INTRODUCTION

The average duration of human gestation is 266 days starting, commencing from the day of conception or 280 days from the first day of the last normal menstrual period (LNMP), assuming that a typical menstrual cycle is 28 days and ovulation occurs approximately on day 14.[1] Gestational age (GA) is estimated to determine whether or not a newborn will be born prematurely.[2] In the past, GA was predicted by combining historical data from the mother and physical examination.[3] Naegele's rule, a simple calculation used to estimate the expected date of delivery, remains the current standard for calculating the length of pregnancy based on the LNMP.[4]

Newborns with abnormal fetal development are often more vulnerable to metabolic derangements involving hypoglycemia and polycythemia throughout the early years of life. The alternate anthropometry parameters like the mid-upper arm, mid-thigh, and mid-calf circumference can be used to assess newborn growth and identify at-risk infants. Some previous studies have established a substantial relationship between mid-upper arm and thigh circumference with gestational age.[3,4]

Fetal growth is based on genetic, placental and maternal factors. Morbidity and mortality in newborns are directly related with gestational age and weight. An estimated 1 million babies die globally every year because of prematurity, of which about 375,000 neonatal deaths due to prematurity and low birth weight occur in India alone.[5,6] There are various methods for assessing gestational age and each has its own advantages and disadvantages, till now no gold standard method was available for gestational age assessment. Early-pregnancy ultrasound is thought to be the gold standard for assessing Gestational age. Due to late antenatal care, problems with last normal menstrual period memory due to the use of hormonal contraceptives which is not reliable or due to maternal diseases, low literacy, and a lack of access to ultrasonography, and skilled personnel in using ballards scoring Gestational age estimation was problematic in low-resource settings. Preterm birth contribute for 28% of all newborn deaths and is the second most common cause of death in children under the age of five. The 15 million preterm births that occur annually around the world take occurs in low- and middle-income nations, where the problem is most severe.[7-10]

The main purpose of this study was to design a simple method in assessment of gestational age in rural health centre done by low skilled personnel in low resource setting by using anthropometric parameters.

MATERIAL AND METHODS

This cross sectional observational study was carried out in 200 babies born in Department of Pediatrics Tertiary Care Teaching Institute of India for the duration of 1 year.

Ethical approval was taken from the institutional ethical committee and written informed consent was taken from all the participants.

Inclusion Criteria

All neonates appropriate for gestational age were included.

The excluded infants were newborns with congenital limb anomalies, multiple gestation pregnancy (twins, triplets, quadruplets, etc.), intrauterine growth restriction births and stillbirths,

gestational diabetes mellitus, and pregnancy complications, such as anaemia and eclampsia.

The babies were selected by simple random technique. The sociodemographic data were collected using semi structured questionnaire. All anthropometric measurements were measured as per "handbook of physical measures" by Hall et al for foot length comparison for gestational age Merz data was used, New ballards scoring system for assessment of gestational age was given in (Table 1).[11]

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

RESULTS

The mean gestational age among neonates studied is 37.10±2.45 weeks, around 3% were early preterm, 6% were moderate preterm, 22% were late preterm and 68% were term. [Table 1]

The mean birth weight is 2.60±0.51 kg in our study, the mean head circumference is 33.80±1.10 cm, and majority of them babies had head circumference 33 cm (Table 2). The mean chest circumference is 31.01±1.25 cm, and majority of the babies, had chest circumference of 30 cm and above, the mean foot length is 7.40±0.50 cm and the mean length of the babies is 48.24 ±1.30. [Table 2] The p value 0.001 suggested there is positive correlation between increase in foot length and gestational age. The mean value of foot length as per term of delivery of baby shows significant result. (p≤0.05) The foot length is 7.2 in extreme preterm, 7.3 cm in early preterm, 7.7 in late preterm and 7.8 cm in term and 7.9 cm in post term. There is positive correlation between foot length, head, chest circumference and length with gestational age at birth with p value of 0.001.

Table 1: Socio-demographic and obstetric data of new born

Socio demographic data	Number	Percentage (%)
Age in hours (mean±SD)	8.10±2.3	
Gender		
Male	104	52
Female	96	48
Gestational age in weeks (mean±SD)	37.10±2.45	
Term of birth		
Extreme preterm	2	1
Early preterm	6	3
Moderate preterm	12	6
Late preterm	44	22
Term	136	68
Ante natal risk factors		
Present	52	26
Absent	148	74

Table 2: Anthropometric Measurements of Newborn Studied

Measures	Head circumference in cm	Chest circumference in cm	Foot length in cm	Length in cm
Mean	33.80	31.01	7.40	48.24
Std. deviation	1.10	1.25	0.50	1.30

DISCUSSION

A newborn's maturity level is important to identify postpartum morbidity and mortality since a baby with a very low maturity level had a high risk profile than one with a high birth weight, other neonatal issues like intraventricular hemorrhage, patent ductus arterious, and retinopathy of prematurity are also influenced by the baby's birth weight. It is difficult to distinguish between little for date and less mature babies when determining the baby's maturity accurately especially when the infant weighs little.

In our study, there was a significant correlation of gestational age with birth weight, length, foot length, head and chest circumference. Similar to our results, Das et al carried out a cross-sectional study with 530 continuously live-born infants between the ages of 28 and 41 in a tertiary care hospital, the study suggests that head circumference and Crown Heel Length can be used as simple methods for predicting Gestational age in babies when this is unknown. This can help identify high-risk newborns early without the use of imaging methods.[11] Between October 2019 and April 2020, Tiruneh conducted a cross-sectional study at Dessie Referral Hospital on 424 live births that was between 28 and 42 weeks gestation, the study showed the significant correlation of head circumference, crown heel length and birth weight with gestational age.[12] In a research by Kumar et al 209 consecutive live births of singletons between 28 and 40 weeks of gestation was enrolled, foot length is a straightforward calculation, it can be used as a substitute for the New Ballard score.[13] Our study result was consistent with research done in India by Thawani et al.[14] A study by Yadav et al in India, which explained that birth weight, foot length, head circumference, and crown-heel length had a positive connection with gestational age, and this study, concurred on this point.[15]

The average foot length in the study by Kumar et al was 6.8 centimetres, or 34 weeks, a linear connection was seen when gestational age was plotted against mean foot length.[16] This finding is supported by the studies conducted in Dire Dawa in Ethiopia, Belgium, Gondar (Ethiopia) and India (r = 0.43).[17-20]

Our study suggested that anthropometric measurements can be used in assessment of gestational age, foot length as an important marker among all anthropometric measures in gestational age measurement.

Limitations of the study were as this was a cross sectional study. Further comparative study was recommended. This was hospital based single centric study. So the results may have varied based on the level of health care the babies were delivered.

CONCLUSION

Our study concluded that anthropometeric parameters in combination and as single parameters was a simple and easy tool for assessing gestational age in low resource setting where we can make a quick referral. Analyzing anthropometric measures after delivery allows a quick assessment of infants with unusual growth more vulnerable to metabolic complications.

REFERENCES

1. Edwards KI, Itzhak P. Estimated date of delivery. Treasure Island, FL: StatPearls Publishing (2020).
2. Tiruneh C. Estimation of gestational age using neonatal anatomical anthropometric parameters in Dessie Referral Hospital, Northeast Ethiopia. Risk Manag Healthc Policy. (2020) 13:3021. doi: 10.2147/ RMHP.S280682
3. MacGregor SN, Sabbagha R. Assessment of gestational age by ultrasound. Glob Libr Womens Med. (2008). doi: 10.3843/GLOWM.10206
4. Lawson GW. Naegele's rule and the length of pregnancy–a review. Aust N Z J Obstet Gynaecol. (2021) 61(2):177–82. doi: 10.1111/ajo.13253
5. World Health Organization. Child health profile: India. Geneva: Department of Child and Adolescent Health and Development, World Health Organization, 2007: 7.
6. Howson CP, Kinney MV, Lawn JE, McDougall L. Born too soon: preterm birth matters. Reprod Health. 2013;10(1):1
7. Moller AB, Petzold M, Chou D, Say L. Early antenatal care visits: a systematic analysis of regional and global levels and trends of coverage from 1990 to 2013. Lancet Glob Health. 2017;5(10):977-83.
8. Alexander GR, Allen MC. Conceptualization, measurement, and use of gestational age. Clinical and public health practice. J Perinatol. 1996;16(1):53-9.
9. Althabe F, Belizán JM, Mazzoni A, Berrueta M, Hemingway-Foday J, Koso-Thomas M, et al. Antenatal corticosteroids trial in preterm births to increase neonatal survival in developing countries: study protocol. Reprod Health. 2012;9(1):22.
10. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet. 2015;385(9966):430-40.
11. Hall J, Froster Iskenius UG, Allanson JE. Handbook of normal physical measurements. Oxford med publication; 1989: 221-51.
12. Tiruneh C. Estimation of gestational age using neonatal anatomical anthropometric parameters in Dessie Referral Hospital, Northeast Ethiopia. Risk Manag Healthc Policy. 2020; 13:3021-9.
13. Kumar V, Tikkas DR, Ramteke DS, Shrivastava DJ. Assessment of gestational age using anthropometric parameters: an observational study in India. Int J Pediatr Res. 2017;4(11):672-80. 14. Thawani R, Dewan P, Faridi M, Arora SK, Kumar R. Estimation of gestational age, using neonatal anthropometry: a cross-sectional study in India. J Health Popul Nutr. 2013;31(4):523-30.
14. Yadav R, Bhatnagar P, Gunjan. Gestational age assessment in newborns using regression equation of anthropometric

parameters singly or in combination. Int J Biomed Res. 2016;7(8):600-5.

15. Senthilkumar K, Senthilprabhu R, Mythili B, Zacharias AN. Prediction of gestational age of newborn by measurement of foot length at birth. Int J Comtem Pediatr. 2019;6(1):135-9.

16. Sintayehu E, Sintayehu Y, Oumer A, Berhane A. Identification of anthropometric surrogate measurements and their cut-off points for the detection of low birth weight and premature newborn babies using ROC analysis. J Nutr Sci. (2023) 12: e32. doi: 10.1017/jns.2023.20

17. Manjunatha B, Nithin M, Sameer S. Cross sectional study to determine gestational age by metrical measurements of foot length. Egypt J Forensic Sci. (2012) 2(1):11–7. doi: 10.1016/j.ejfs.2011.11.003

18. Wyk LV, Smith J. Postnatal foot length to determine gestational age: a pilot study. J Trop Pediatr. (2016) 62(2):144–51. doi: 10.1093/tropej/fmv093

19. Dagnew N, Tazebew A, Ayinalem A, Muche A. Measuring newborn foot length to estimate gestational age in a high risk Northwest Ethiopian population. PLoS One. (2020) 15(8): e0238169. doi: 10.1371/journal.pone.0238169

20. Thawani R, Dewan P, Faridi M, Arora SK, Kumar R. Estimation of gestational age, using neonatal anthropometry: a cross-sectional study in India. J Health Popul Nutr. (2013) 31(4):523. doi: 10.3329/jhpn. v31i4.20051.