Review Article

Indian Journal of Maternal-Fetal and Neonatal Medicine
Volume 8 Number 1, January – June 2021
DOI: http://dx.doi.org/10.21088/ijcd.2395.6631.8121.5

Postnatal Methods for Gestational Age Assessment in Newborns

[1]Mani Raj, [2]Karthikeyan Kadirvel, [3]Sumathisri Ramachandran

How to cite this article:
Mani Raj, Karthikeyan Kadirvel, Sumathisri Ramachandran, Postnatal Methods for Gestational Age Assessment in Newborns. Indian J Matern Fetal Neonatal Med. 2021; 8(1):33–36.

Author's Affiliations: [1]Junior Resident, [2]Associate Professor, [3]Assistant Professor Department of Pediatrics, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry 607402, India.

Corresponding Author: Karthikeyan Kadirvel, Associate Professor Department of Pediatrics, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry 607402, India.

E-mail: mail2dr.mani16@gmail.com

Abstract

The estimation of gestational age (GA) is important in planning appropriate treatment for the infant and to modify details of care. The development of many neonatal issues in the immediate postnatal period is dependent on gestational age. Hence its accurate assessment is essential for perinatal practice. The best estimate of GA is based on sonography if it is performed before 22 weeks of gestation. When a consistent date of last menstrual period (LMP) or an early sonographic report is not available, postnatal assessment methods of newborn maturity is required. Widely used Expanded new Ballard Score with physical and neurologic criteria is complex and needs trained personnel to execute. Scores using physical criteria alone are easy to perform, less time consuming and has good interobserver reliability. These can be performed reliably even by non-pediatricians compared to score containing both physical and neurological criteria.

Keywords: Gestational Age; Ultrasonography; New Ballard Score; Eregie Score; Parkin Score.

Introduction

The awareness about gestational age (GA) is important for Obstetricians and Neonatologists which is routinely determined either prenatally or postnatally.[1] There are several methods of estimating GA. Prenatally, the last menstrual period (LMP) and sonographic assessment are commonly used. Conventionally, GA is estimated using the first day of the last menstrual period (LMP), which assumes that ovulation occurs on day 14 of the menstrual cycle. This method may not be dependable in the situations like by irregular menses, unknown or uncertain dates, oral contraceptive use or recent pregnancy or conception while breastfeeding and a possibility of recall bias which is common in larger proportion of women.[2,3,4] Hence, early (<14 weeks' gestation) ultrasound measurement of fetal crown rump length (CRL) is recommended.[5] USG before 14 weeks of gestation is gold standard because it is superior to dating based on the LMP or physical examination and also provides information about fetal development. The investigative performance of sonographic estimation is usually influenced by quality of the images, multiple gestation, fetal position, fetal anomalies and biologic variations. The ACOG (American College of Obstetricians and Gynecologists) consider pregnancies "sub-optimally" dated in the absence of USG examination before 22 weeks of gestation confirming the EDD. In LMICs (low middle income countries), where high-risk pregnancies are prevalent, women do not seek their first antenatal care visit during early pregnancy and even postpone at the time of delivery.[4] Hence, management of neonatal complications and implementing evidence-based interventions becomes difficult. In resource limited settings, accurate menstrual dating and results from USG performed during early trimester may not be available. In such situations, GA is determined postnatally based on physical examination

alone or in combination with neuromuscular assessment. Postnatal assessments are also used to confirm the GA determined prenatally. Gardosi et al has observed that GA estimation by LMP systematically over-estimated at term when compared with USG. GA assessment by early trimester USG should be implemented universally. Such a policy, however, can only be feasible in settings where women enroll early for antenatal care, which is not the case for many women in our setting.[5]

This literature search aimed at reviewing different GA assessment scores done after delivery, overview of each method, and comparison of methods in terms of simplicity, applicability and accuracy.

Methods

The PubMed database was searched for English language studies and relating to gestational age assessment. The keywords used are: gestational age, assessment methods, antenatal, postnatal, physical criteria and neurological criteria. Articles were considered for inclusion if the study met the following criteria: included live born neonates, comparison of postnatal assessment methods with either LMP or USG-GA; reported at least one statistic analysis of correlation, agreement or validity of GA estimation. Results were reviewed by all the authors. Additional articles were identified by searching reference lists provided in the articles selected for review.

Review Results

Postnatal Assessment of Gestational Age

Gestational age assessment should be done as early as possible after delivery. The methods utilize physical and neurologic criteria either alone or in combination. Physical criteria alone have shown promising results for gestational age determination. The physical criteria was initially illustrated by Farr[6] and later detailed by Finnstrom[7] that integrated skin colour, nipple formation, ear firmness and plantar creases. These criteria are considered easier to determine and more reliable than neurological criteria and have been recognized by various authors as valuable markers of foetal maturation[8]. Extent of creases on the sole of the foot, presence and size of the breast nodule, lanugo presence, ear cartilage characteristics, and appearance of genitalia constitute the set of external characteristics. These can be evaluated after delivery. The neurologic criteria described by Amiel-Tison includes the assessment of posture, active and passive tone and reflexes[9].

Physical and Neurological Maturity estimation

Over the past three decades, researchers have attention in ways of estimating GA in newborns using external and neurological characteristics.[8] Issues encountered in GA assessment using USG and LMP dates, as previously highlighted, paved the way for development of simple cotside scoring systems for assessment of thematurity of newborn which are less technologically oriented, pain-free and economical[10]. These methods use either a series of external criteria, neurological criteria, or a combination of both. The central nervous system and skin maturity are reflected by neurological and physical criteria respectively.

After initial search, we restricted to the following four GA assessment tools by Dubowitz et al.[11], Ballard et al.[12], Parkin et al[13] and Eregie et al[14] since the latter two are simple with external characteristics as the prime component of GA estimation.

Dubowitz Method

This method was used widely before the development of new Ballard score. The revised Dubowitz score incorporates 34 physical and neurological criteria. These are divided into 6 categories (tone, tone patterns, reflexes, movements, abnormal signs and behaviors). Numerous criteria that need evaluation, difficult to perform in sick neonates and overestimation of GA in preterms are the major disadvantages.

Studies have reported a mean difference in GA between Dubowitz and USG-GA ranging from under-estimation by 2.2 weeks and overestimation by 0.7 weeks.[15,16] There was overestimation by this score among the early preterm infants.[17]

Ballard Method

This method shortened the Dubowitz method to depend upon six physical and neurologic criteria. Which can be accomplished more quickly. However, this method may be inaccurate in infants who are preterm, post-term or small for gestational age. This system was modified as the new ballard score (NBS) to improve assessment of preterms as early as 20 weeks. In a study performed on 223 infants who were 22 to 28 weeks gestation by LMP, NBS overestimated GA by 1.3 to 3.3 weeks.

The mean GA difference ranged from underestimation of 0.41 weeks to an overestimation by 1.4 weeks by NBS as compared to USG-GA. The bias observed by this scoring for SGA babies was more when compared to non SGA babies.[18,19,20]

Parkin score

This is an uncomplicated and effortless method for rapid assessment of GA at birth based on skin colour, skin texture, breast development and ear firmness that can be performed in sick neonates without any manipulation or movement. GA estimated by Parkin score were within $\pm$ 15 days at any time in the first two days of life. This system is least accurate in babies < 30 weeks gestation. There can be racial differences while assessing this scoring system since the authors have derived this score in British neonates.

Parkin score underestimated the GA by 0.17 (0.26 – 0.08) weeks when compared to gold standard USG-GA.[21,22]

Modified Eregie score

This model is a suitable clinical tool for rapid and reliable maturity determination in healthy and sick newborns. Scoring involves a combination of external features and anthropometric parameters which reflect maturational skin changes and intrauterine growth of brain and

muscle/fat mass respectively. This model had a comparable accuracy of maturity determination when compared with the Dubowitz system. Among the sick infants this model performed better when compared to the previous simplified scores. The anthropometric parameters were better correlating than the external features. The scores were unaffected by the neurological maturity, which has implications for the diagnosis, management and prognosis.

Studies Eregie score which showed 93.4% of the estimation was within 2 weeks of estimation of date of delivery by LMP.[23,24]

In a study conducted in a developing country, evaluating GA estimation by nurses in, the physical criteria of NBS alone was used which performed favorably with the Dubowitz method.[25] The assessors in that study had very minimal or no prior experience of estimating GA but with some training, found assessment with physical criteria was much easier and quicker. These findings can easily be applicable in an environment with paucity of skilled manpower.

Sunjoh et al., stated that Dubowitz and Eregie model had analogous validity for the total population but this method was less valid for preterm (<28 weeks) and post-term babies[24]. Kavita et al., compared NBS and Parkin stated that 95 % of the values lies within the LOA and Parkin showed better accuracy within ± 12 days, especially in sick and preterm neonates.[19]

Conclusion

Newborn assessment for GA by USG has become relevant in high income settings, where ultrasound coverage is high. Widespread access to early ultrasound dating and accuracy of LMP recall is highly unpredictable in LMIC settings. Precise GA determination is a public health priority to target and reduce preterm birth–related morbidity and mortality in such environment. The most commonly used scores in many clinical settings and most widely studied in the literature are the Dubowitz and Ballard scores. Although researchers in several studies showed promise of simplified scores for assessment. Gestational age estimation of neonates by postnatal assessment is crucial in population who do not have reliable early trimester ultrasonography reports. Scores using external characteristics alone or in combination with anthropometric parameters are easy to perform, less time consuming and has good interobserver reliability. These can be performed reliably even by non-pediatricians compared to score containing both physical and neurological criteria.

References

1. Gagliardi L, Brambilla C, Bruno R, Martinelli S, Console V. Biased assessment of gestational age at birth when obstetric gestation is known. Arch Dis Child. 1993;68:32–4.
2. Aliyu LD, Kurjak A, Wataganara T,et al. Ultrasound in Africa: what can really be done? J Perinat Med. 2016;44(2):119–123
3. Savitz DA, Terry JW Jr, Dole N, Thorp JM Jr, Siega-Riz AM, Herring AH.Comparison of pregnancy dating by last menstrual period, ultrasound scanning, and their combination. Am J Obstet Gynecol.2002;187(6):1660–1666
4. Rosenberg RE, Ahmed AS, Ahmed S, Saha SK, Chowdhury MA, Black RE, et al. Determining gestational age in a low-resource setting: validity of last menstrual period. J Health Popul Nutr. 2009; 27 (3):332 - 8. PMID: 19507748
5. Hutchon DJR. "Expert" analysis of menstrual and ultrasound data in pregnancy-gestational dating. J Obstet Gynaecol. 1998;18(5):435–8.
6. Farr V, Mitchell RG, Neligan GA, Parkin JM. The definition of some external characteristics used in the assessment of gestational age in the newborn infant. Dev Med Child Neurol. 1966 Oct;8(5):507-11. doi: 10.1111/j.1469-8749.1966.tb01796.x. PMID: 5972871.
7. Finnström O. Studies on maturity in newborn infants. IX. Further observations on the use of external characteristics in estimating gestational age. Acta Paediatr Scand. 1977 Sep;66(5):601-604.
8. Kerridge VFDF, Mitchell RG. The Value of Some External Characteristics in the Assessment of Gestational Age at Birth. Dev Med Child Neurol. 2008;8(6):657–60.
9. Amiel-Tison C: Neurological evaluation of the maturity of newborn infants, Arch Dis Child 43:89, 1968.
10. Wariyar U, Tin W, Hey E. Gestational assessment assessed. Arch Dis Child - Fetal Neonatal Ed. 1997;77(3):F216–20.
11. Dubowitz LMS, Dubowitz V, Goldberg C. Clinical assessment of gestational age in the newborn infant.] Pediatr 1970;77:1-10.
12. Ballard JL, Khoury JC, Wedig K, Wang L, Eilers-Walsman BL, Lipp R. New Ballard Score, expanded to include extremely premature infants. J Pediatr. 1991; 119(3):417±23.
13. Parkin JM, Hey EN, Clowes JS. Rapid assessment of gestational age at birth. Arch Dis Child 1976: 51: 259-63.
14. Eregie CO. Assessment of gestational age: modification of a simplified method. Dev Med Child Neurol. 1991 Jul; 33(7): 596-600. PMID: 1879623.
15. Vik T, Vatten L, Markestad T, Jacobsen G, Bakketeig LS. Dubowitz assessment of gestational age and agreement with prenatal methods. Am J Perinatol. 1997; 14(6): 369–373
16. Awoust J, Keuwez JJ, Levi S. Comparison between three methods for assessment of fetal age. J Foetal Med. 1982; 2(1): 11–15
17. Shukla H, Atakent YS, Ferrara A, Topsis J, Antoine C. Postnatal overestimation of gestational age in preterm infants.Am J Dis Child. 1987;141(10):1106–1107
18. Moraes CL, Reichenheim ME. Validity of neonatal clinical assessment for estimation of gestational age: comparison of new Ballard score with date of last menstrual period and ultrasonography. Cad Saude Publica. 2000; 16(1): 83–94
19. Sreekumar K, d'Lima A, Nesargi S, Rao S, Bhat S. Comparison of New Ballards score and Parkins

score for gestational age estimation. Indian Pediatr. 2013; 50(8):771–773
20. Wylie BJ, Kalilani-Phiri L, Madanitsa M, et al. Gestational age assessment in malaria pregnancy cohorts: a prospective ultrasound demonstration project in Malawi. Malar J. 2013;12:183
21. Vogt H, Haneberg B, Finne PH, Stensberg A. Clinical assessment of gestational age in the newborn infant. An evaluation of two methods. Acta Paediatr Scand. 1981;70(5):669–672
22. Karunasekera KA, Sirisena J,Jayasinghe JA, Perera GU. How accurate is the postnatal estimation of gestational age? J Trop Pediatr. 2002; 48(5): 270–272
23. Lee AC, Mullany LC, Ladhani K, et al; Projahnmo Study Group. Validity of newborn clinical assessment to determine gestational age in Bangladesh. Pediatrics. 2016; 138(1): e20153303
24. Sunjoh F, Njamnshi AK, Tietche F, Kago I. Assessment of gestational age in the Cameroonian newborn infant: a comparison of four scoring methods.J Trop Pediatr. 2004; 50(5): 285–291
25. Verhoeff FH, Milligan P, Brabin BJ, Mlanga S, Nakoma V. Gestational age assessment by nurses in a developing country using the Ballard method, external criteria only. Ann Trop Paediatr. 1997 Dec;17(4):333-42.doi:10.1080/02724936.1997.11747907. PMID: 9578793.