

Original Research Article

Prevalence of small for gestational age term neonates and its surrogate marker

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Received: 20 February 2019

Accepted: 01 April 2019

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ABSTRACT

Background: The incidence of low birth weight babies continues to be high in India at about 30% in contrast to 5-7% in developed countries. Perinatal, neonatal and infant mortality as well as morbidity is associated with low birth weight (LBW) neonates of which, it is the Small for Gestational Age (SGA) neonates that are at increased risk. Henceforth, it becomes important to study the prevalence of SGA babies and to compare various anthropometric measurements among term neonates for assessing as to which of these could be taken as surrogate markers of small for gestational age babies.

Methods: It was a cross sectional study conducted over a period of 2 years among 100 term neonates delivered in a private medical college in Puducherry, India.

Results: The prevalence of low birth weight babies and small for gestational age was found to be 40% and 30% respectively. Using mid arm circumference as a predictor, the sensitivity, specificity, positive predictive value and negative predictive value of SGA was found to be 100%, 57.14%, 50% and 100% respectively. Using MAC/HC ratio as a predictor, the sensitivity, specificity, positive predictive value and negative predictive value was found to be 46.67%, 100%, 100% and 81.4% respectively.

Conclusions: In predicting SGA babies, mid arm circumference has the highest sensitivity whereas MAC/HC ratio has the highest specificity followed by mid arm circumference. Present study concluded that mid arm circumference and ratio of MAC/HC are very helpful in identifying SGA neonates among term neonates.

Keywords: Low birth weight, Small for gestational age, Mid arm circumference, Mid arm circumference/head circumference

INTRODUCTION

Fetal malnutrition (FM) is a term coined by Scott KK et al, in 1966 to describe infants who showed evidence of soft tissue wasting at birth irrespective of the specific etiology.¹ The incidence of low birth weight babies continues to be high in India at about 30% in contrast to 5-7% in developed countries, of which only 10% of babies are low birth weight, the rest being categorized as

fetal malnourishment.² This condition has to be sorted out owing to the prevalence of high neonatal mortality and morbidity and its long term risk of developing coronary heart disease, diabetes, hypertension and stroke in adulthood.

The reference criteria for defining fetal malnourishment have been very variable. Various measures like weight for gestational age, length, ponderal index, body mass

index, mid-arm circumference and ratio of mid-arm circumference to head circumference have been suggested to identify fetal malnutrition. Perinatal, neonatal and infant mortality as well as morbidity is associated with Low birth weight (LBW) neonates of which, it is the Small for Gestational Age (SGA) neonates that are at increased risk. It is well recognized that all LBW neonates are not always Small for Gestational Age (SGA). Early recognition of the risks to which a child is exposed at birth allows better organization of perinatal care, optimization of available resources, and provision of tertiary level health care to those babies who really need it.

Henceforth, it becomes important to study the prevalence of SGA babies and to compare various anthropometric measurements among term neonates for assessing as to which of these could be taken as surrogate markers of small for gestational age babies.

The aim was to study the prevalence of SGA babies and to compare various anthropometric measurements such as length, head circumference, mid-arm circumference, ratio of mid-arm circumference to head circumference as predictors of small for gestational age term neonates.

METHODS

It was a cross sectional study conducted over a period of 2 years among 100 term neonates delivered in a private medical college in Puducherry, India. Term newborns (<72 hours age) born of single pregnancies of gestational age (between 37 weeks and 41 weeks and 6 days) as estimated by using new Ballard score were included in this study. Neonates with large Cephalo-hematomas/Sub-galeal bleeds, major congenital anomalies especially involving head or limbs, fractured upper limbs, infants of diabetic mothers and those with refusal of consent were excluded. These neonates were clinically assessed using a proforma following informed consent and the anthropometric measurements were recorded.

The weight was obtained with the naked infant in dorsal decubitus, soon after birth still in the delivery room, using an electronic balance with a maximum capacity of 15 kg and a minimum of 125 g, and 5 g subdivisions previously calibrated. The Mid-arm and head circumferences were measured within the first 48 hours of life, using a fiberglass non-extendable measuring tape, with a width of 1.0 cm and subdivisions of 0.1 cm. The mid-arm circumference was obtained from the left arm, at the midpoint between the acromion and olecranon, with the newborn in dorsal decubitus with the arm lying laterally to the trunk, with the elbow flexed at an angle of 90° and the mean value (rounded to the nearest 0.1 cm) of three consecutive measurements was considered for analysis. The head circumference was measured with the newborn in dorsal decubitus position with the measuring tape placed along the occipito-frontal circumference, just over the eyebrows and the occiput, in order to obtain the

largest measurement and maximum value (rounded to the nearest 0.1 cm) of three consecutive measurements was considered. The various parameters were further analysed using SPSS software.

RESULTS

The present study includes a sample size of 100 neonates of which 47 were males and 53 were females. The prevalence of low birth weight babies and small for gestational age was found to be 40% and 30% respectively. The mean values of length, head circumference, mid arm circumference and mid arm circumference to head circumference ratio of SGA babies are less compared to the mean values of length, head circumference, mid arm circumference and mid arm circumference to head circumference ratio of the rest of the normal babies as in Table 1.

The study showed that 28 of 30 (93.3%) SGA babies and 62 of 70 (88.57%) normal babies had length less than 50 cm. Using length as a predictor, the sensitivity, specificity, positive predictive value and negative predictive value was found to be 93.33%, 11.42%, 31.11% and 80% respectively. The association of length and SGA babies was not statistically significant as p value of chi square test was found to be 0.466.

Table 1: Mean, standard deviation and range of anthropometric measurements of the total study sample.

Clinical parameters	SGA babies		AGA/LGA babies	
	Mean	SD	Mean	SD
Length	46.6	1.404	49.557	0.734
HC	33.57	0.678	34.378	0.573
MAC	8.12	0.147	9.921	0.903
MAC/HC	0.241	0.006	0.285	0.0211

In the present study, 29 of 30 (96.67%) SGA babies and 69 of 70 (98.57%) normal babies had head circumference less than or equal to 35 cm. Using head circumference as a predictor, the sensitivity, specificity, positive predictive value and negative predictive value was found to be 96.67%, 1.42%, 32.22% and 50% respectively. The association of head circumference and SGA babies was not statistically significant as p value of chi square test was found to be 0.532.

The study also showed all 30 (100%) SGA babies had mid arm circumference less than or equal to 10 cm as compared to 30/70 (42.8%) of normal babies. Using Mid arm circumference as a predictor, the sensitivity, specificity, positive predictive value and negative predictive value was found to be 100%, 57.14%, 50% and 100% respectively. The association of mid arm circumference and SGA babies was statistically significant as p value of chi square test was found to be less than 0.0001.

With regard to mid arm circumference and head circumference ratio, the study showed all the babies who had a ratio of <0.24 were found to be SGA babies and among babies with a ratio more than or equal to 0.24 (total no. 86), majority of them ($n=70$, 81%) were Appropriate for gestational age leaving only a small percentage ($n= 16$, 19%) of them were found to be SGA

neonates stating the association to be highly significant statistically (the p value of the chi square test being less than 0.0001) as in Table 2. Using MAC/HC ratio as a predictor, the sensitivity, specificity, positive predictive value and negative predictive value was found to be 46.67%, 100%, 100% and 81.4% respectively.

Table 2: Chi-Square test results for various parameters in association with SGA babies.

Parameters		Total	SGA	AGA/LGA	X ² Value	'p' Value
Length	≤ 50 cm	90 (90%)	28 (31.1%)	62 (68.9%)	0.529	0.466 (NS)
	>50 cm	10 (10%)	2 (20%)	8 (80%)		
HC	≤ 35 cm	98 (98%)	29 (29.6%)	69 (70.4%)	0.388	0.532 (NS)
	>30 cm	2 (2%)	1 (50%)	1 (50%)		
MAC	≤ 10 cm	60 (60%)	30 (50%)	30 (50%)	28.571	<0.0001 (S)
	>10 cm	40 (40%)	0 (0%)	40 (100%)		
MAC/HC	<0.24	14 (14%)	14 (100%)	0 (0%)	37.984	<0.0001 (S)
	≥ 0.24	86 (86%)	16 (18.6%)	70 (81.4%)		

S- Significant, NS- Not Significant

DISCUSSION

The present study included a sample size of 100 babies, of which 40% babies were Low Birth Weight (LBW i.e., birth weight <2.5 kg), which included 75% small for gestation age neonates and the rest were appropriate for gestational age. A study conducted in india proved 33% prevalence of low birth weight among term neonates (3) and a study conducted at AJIMS by Zaheer A et al, showed higher prevalence of (62.6%) SGA babies.^{3,4}

The association of length and head circumference and prevalence of SGA babies were not statically significant. However, Sankhyan N et al, in their study concluded that head circumference was highly correlating with birth weight.⁵

The study revealed a highly significant correlation of mid arm circumference with the prevalence of SGA babies, with similar results found in a study conducted by Sood SL et al.⁶ Ahmed FU et al, in their study concluded that a MAC of <9.0 cm had the best sensitivity and specificity for identifying newborns with a birth weight of less than 2500 gms and is a simple, quick and reliable indicator for predicting low birth weight.⁷

The association of mid arm circumference and head circumference ratio and SGA babies is also highly significant statistically with similar results revealed in a study done by Georgieff MK et al, concluded that MAC/HC ratio is more accurate than ponderal index for the evaluation of fetal malnutrition.⁸⁻¹⁰

This study is very useful to identify SGA babies especially who are born in rural level areas where

facilities are limited and the available resources can be utilized to provide the necessary health care to such identified high risk babies and to transport them to the sub center or tertiary health care facility so as to reduce the burden of infant mortality.

CONCLUSION

The present practice of classifying babies on the basis of weight to SGA, AGA and LGA has helped in their overall management to some extent. But this has not brought down the infant mortality rate to the expected levels. The present study was simple, systematic method which does not require any sophisticated equipments or laborious calculation and can be used as a routine and preferred method in detecting SGA babies especially in rural areas where even a social health care worker can use this tool in order to reduce the burden of perinatal and neonatal morbidity and mortality.

Present study showed a prevalence of low birth weight neonates and small for gestational age neonates to be 40% and 30% respectively. The association of mid arm circumference and mid arm circumference and head circumference ratio and SGA babies shows statistical significance. In predicting SGA babies, mid arm circumference has the highest sensitivity whereas MAC/HC ratio has the highest specificity followed by mid arm circumference.

Present study concluded that mid arm circumference and ratio of MAC/HC are very helpful in identifying SGA neonates among term neonates and thereby can be used as "Surrogate markers for predicting SGA babies".

Thus, it is a cost-effective method, easily obtainable and feasible for the use at a larger population, when used can be a served resource in providing the community with healthier babies.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Vinay SGS, Karthiga K, Shrivastava A. Prevalence of small for gestational age term neonates and its surrogate marker. Int J Contemp Pediatr 2019;6:1247-50.