



Evaluation of fetal malnutrition by clinical assessment of nutritional status score (CAN Score) and anthropometric indices

Dr. Manish Ranjan¹, Dr. Ashok Kumar^{2*}, Dr. Arunabh Kumar³

^{1,3} Junior Resident, Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India

² Associate Professor, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Bihar, India

* Corresponding Author: Ashok Kumar

Abstract

A baby's weight at birth is a strong indicator of maternal and newborn health and nutrition. Being undernourished in the womb increases the risk of death in the early months and years of a child's life. Those who survive tend to have impaired immune function and increased risk of disease; they are likely to remain undernourished, with reduced muscle strength, cognitive abilities and IQ throughout their lives. As adults, they suffer a higher incidence of diabetes and heart disease. Hence based on above findings the present study was planned for Evaluation of Fetal Malnutrition by Clinical Assessment of Nutritional Status Score (CAN Score) and Anthropometric Indices.

The present study was planned in Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar during the period of June 2019 to February 2020. Total 100 cases of new borns delivered in our hospital were enrolled in the present study. The following parameters were recorded in all babies (Weight was recorded at birth, clinical assessment of nutrition score, length, mid arm circumference and head circumference were recorded between 24-48 hrs of life). Nude birth weight was recorded using electronic weighing scale. Length was measured using infantometer. Mid arm circumference (MAC) was measured in the left arm at a point midway between tip of the acromion and the olecranon process. Head circumference (HC) was taken at the largest circumference of skull using a non-stretchable tape.

The data generated from the present study concludes that classifying babies on basis of weight as SGA, AGA and LGA may miss to diagnose some of the cases who are affected very late in third trimester. CAN Score is a simple systematic method to identify fetal malnutrition. It does not require any sophisticated equipment's or time-consuming calculations. Hence it is the method preferred for/ ideal for screening malnourished babies.

Keywords: CAN score, fetal malnutrition, body mass index, ponderal index, SGA, etc

Introduction

Fetuses with IUGR who survive the compromised intrauterine environment are at increased risk for neonatal morbidity. Morbidity for neonates with IUGR includes increased rates of necrotizing enterocolitis, thrombocytopenia, temperature instability, and renal failure. These disorders are thought to occur as a result of the alteration of normal fetal physiology in utero.

The symmetrically grown infants who were SGA had outcomes very similar to the infants who were appropriate for gestational age and very different prognoses than the asymmetrically SGA fetuses, thus reinforcing the concept of using growth parameters for diagnostic and outcome counseling.

Several authors have noted that these individuals have a greater predisposition to develop a metabolic syndrome later in life, manifesting as obesity, hypertension, hypercholesterolemia, cardiovascular disease, and type 2 diabetes.

In addition to an increased risk of physical sequelae, mental health problems have been found more commonly in children with growth restriction. Zubrick et, Tideman *et al*.

A baby's weight at birth is a strong indicator of maternal and newborn health and nutrition.

In a cohort study in Sweden, a 10-fold increase in late fetal deaths was found among very small fetuses [2]. Similarly,

Gardosi *et al* noted that nearly 40% of stillborn fetuses that were not malformed were SGA [3].

Methodology

The present study was planned in Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar during the period of June 2019 to February 2020. Total 100 cases of new borns delivered in our hospital were enrolled in the present study.

The following parameters were recorded in all babies (Weight was recorded at birth, clinical assessment of nutrition score, length, mid arm circumference and head circumference were recorded between 24-48 hrs of life). Nude birth weight was recorded using electronic weighing scale. Length was measured using infantometer. Mid arm circumference (MAC) was measured in the left arm at a point midway between tip of the acromion and the olecranon process. Head circumference (HC) was taken at the largest circumference of skull using a non-stretchable tape.

Weight and length obtained were plotted on intrauterine growth charts to classify the newborns as appropriate for gestational age (AGA), small for gestational age (SGA) and large for gestational age (LGA) [12, 13]. Ponderal index (PI) was calculated using the formula: weight (gms)X 100/length (cm), 3 value less than 2.2 was considered as an index

of malnutrition [14]. MAC/HC ratio was calculated, value less than 0.27 was considered as an index of malnutrition [15]. Body mass index (BMI) was calculated using the formula: weight (Kg)/ length (m)² a value less than 11.20Kg/m² was considered as an index for malnutrition [16].

Clinical assessment of nutritional status score (CAN Score) was determined on the basis of the readily detectable signs of malnutrition in the newborns as described by Metcoff, CAN score contains nine clinical signs namely hair, cheeks, neck, arms, chest, abdomen, back, buttocks and legs. A CAN score of <25 was used to define fetal malnutrition. 5 Each attribute was scored based on specific described criteria from 1 to 4; 1 being the maximum evidence of malnutrition and 4 being the evidence of good nutrition. The CAN score ranges between 9 as lowest score and 36 as highest score.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was inclusion and exclusion criteria:

Inclusion Criteria: Live born singleton neonates of gestational age between 37 weeks and 42 weeks.

Exclusion Criteria: Preterm neonates, neonates with congenital anomaly, neonates requiring admission to neonatal intensive care unit (NICU), multiple gestation and neonates born to gestational Diabetes Mellitus mother were excluded from the study.

Results & Discussion

Usually the clinical classification of small for gestational age (SGA) babies is based on the observed birth weight below the 10th percentile for the gestational age. Certain infants are genetically predetermined to be excessively large and may manifest fetal malnutrition by soft tissue wasting and chronic fetal asphyxia even though they do not fall below normal range for weight for date. A simple rapid quantifiable clinically applicable scoring system called CANS score to differentiate malnourished from appropriately nourished babies irrespective of birth weight or clinical classification of IUGR, SGA or Appropriate for gestational age.

One of the major challenges in measuring the incidence of low birth weight is the fact that more than half of infants in the developing world are not weighed.

Since neonatal morbidity and mortality is more closely related to nutritional status of newborn at birth than to the birth weight for gestational age, a clinical assessment of nutritional status (CAN score) [18] was developed to differentiate malnourished from appropriately nourished babies. CAN Score measures the visible wasting observed in malnourished newborn. CAN Score identified more babies with Fetal Malnutrition compared to antropometry, making it a reliable tool in detection of Malnutrition. The present communication attempts to compare the utility of CAN score with other commonly used measures for defining nutritional status at birth.

Table 1: Sex of New Born

Parameters	Males	Females	Total
Malnourished (CAN Score < 25)	12	13	25
Well Nourished (CAN Score > 25)	35	40	75
Total	47	53	100

Table 2: Anthropometric characteristics

Parameters	Males
Birth weight (gms)	1685 – 3856
Length (cm)	41.5 – 55.6
Head circumference(cm)	29.5 – 36.4
Mid arm circumference (cm)	7.6 – 11.9
Ponderal index	1.71 – 3.18
MAC/ HC ratio	0.21 – 0.38
Body mass index	8.12 – 14.65

Table 3: Body Index and CAN Score

CAN Score	Malnourished	Normal
Ponderal index: (PI)		
<2.2	17	7
≥ 2.2	12	64
Body mass index: (BMI)		
<11.2	22	19
>11.2	5	54
Mid arm circumference (MAC)/ Head Circumference (HC)		
<0.27	14	21
>0.27	11	54
Gestational age: (GA)		
Small for gestational age (SGA)	22	5
Appropriate GA + Large GA	4	69

It is imperative to develop methodologies and tools, which are simple and sensitive for use at community level, and to screen malnourished babies. It is important to identify these high-risk babies early and give them adequate care needed for their survival. These newborns can also have referred for further evaluation and follow up at a higher center. Deaths among these babies could be reduced with low cost interventions that focus on keeping the baby warm, maintain hygiene, breast feeding support, early identification and management of illness in the first days and weeks of life [19]. This not only reduces the burden in the higher centers but also triages care to those who are truly malnourished.

Ponderal index has also been used by various authors to classify intrauterine growth retarded infants. Miller and Hassanein [20] proposed that a full-term infant is growth retarded if his PI is < 2.2. Man Mohan *et al.* [21] defined SGA as those with PI falling short of 10th percentile for their gestational age so in a term infant PI < 2.25 should be an indicator of intrauterine undernutrition. Ponderal index relies on the principle that length is spared at the expense of weight during period of acute malnutrition; weight and length velocities may be proportionately impaired so infants with chronic insult in utero may be misclassified by PI.

Meadow and colleagues [22] concluded that the MAC/HC ratio, independent of birth weight, readily discriminated the late gestation growth retarded baby. Their study showed that this ratio can be used as a reliable test to identify neonates whose growth is retarded, even when their weight does not fall below 10th percentile. But those babies whose head circumference is reduced because of proportionate growth retardation might not be identified.

MAC/HC ratio, which is independent of birth weight, readily discriminated the late gestational growth retarded babies.

The observations by Metcoff [24] and Mehta *et al.* [25] that SGA and IUGR are not synonymous with fetal malnutrition and it is a clinical diagnosis independent of birth weight for gestational age and ethnic groups is being re-emphasized by the present study. Since CANSORE is simple, clinical

index for identifying fetal malnutrition and may have the potential to predict morbidity associated with it without the aid of sophisticated equipment, it can be advantageous to use such a score in a developing country like India.

A larger subject population would be required to establish the utility of CAN score as a good clinical index for predicting neurodevelopment outcome in infants with fetal malnutrition.

Conclusion

The data generated from the present study concludes that classifying babies on basis of weight as SGA, AGA and LGA may miss to diagnose some of the cases who are affected very late in third trimester. CAN Score is a simple systematic method to identify fetal malnutrition. It does not require any sophisticated equipment's or time-consuming calculations. Hence it is the method preferred for/ ideal for screening malnourished babies.

References

- Severi FM, Rizzo G, Bocchi C, *et al.* Intrauterine growth retardation and fetal cardiac function. *Fetal Diagn Ther.* 2000; 15(1):8-19.
- Cnatingius S, Haglund B, Kramer MS. Differences in late fetal death rates in association with determinants of small for gestational age fetuses: population-based cohort study. *BMJ.* 1998; 316(7143):1483-7.
- Gardosi J, Mul T, Mongelli M, Fagan D. Analysis of birthweight and gestational age in antepartum stillbirths. *Br J Obstet Gynaecol.* 1998; 105(5):524-30.
- Campbell S, Thoms A. Ultrasound measurement of the fetal head to abdomen circumference ratio in the assessment of growth retardation. *Br J Obstet Gynaecol.* 1977; 84(3):165-74.
- Dashe JS, McIntire DD, Lucas MJ, Leveno KJ. Effects of symmetric and asymmetric fetal growth on pregnancy outcomes. *Obstet Gynecol.* 2000; 96(3):321-7.
- Madazli R. Prognostic factors for survival of growth-restricted fetuses with absent end-diastolic velocity in the umbilical artery. *J Perinatol.* 2002; 22(4):286-90.
- Bernstein IM, Horbar JD, Badger GJ, *et al.* Morbidity and mortality among very-low-birth-weight neonates with intrauterine growth restriction. The Vermont Oxford Network. *Am J Obstet Gynecol.* 2000; 182(1 Pt 1):198-206.
- Kaijser M, Bonamy AK, Akre O, *et al.* Perinatal risk factors for ischemic heart disease: disentangling the roles of birth weight and preterm birth. *Circulation.* 2008; 117(3):405-10.
- Hallan S, Euser AM, Irgens LM, Finken MJ, Holmen J, Dekker FW. Effect of intrauterine growth restriction on kidney function at young adult age: the Nord Trøndelag Health (HUNT 2) Study. *Am J Kidney Dis.* 2008 Jan. 51(1):10-20.
- Zubrick SR, Kurinczuk JJ, McDermott BM, *et al.* Fetal growth and subsequent mental health problems in children aged 4 to 13 years. *Dev Med Child Neurol.* 2000; 42(1):14-20.
- Tideman E, Marsal K, Ley D. Cognitive function in young adults following intrauterine growth restriction with abnormal fetal aortic blood flow. *Ultrasound Obstet Gynecol.* 2007; 29(6):614-8.
- Lubchenco LO, Hansman C, Boyd E. Intrauterine growth in length and head circumference as estimated from live births at gestational ages from 26 to 42 weeks. *Pediatrics.* 1966; 37:403-08.
- Battaglia FC, Lubchenco LO. A practical classification of newborn infants by weight and gestational age. *J Pediatr.* 1967; 71:159-63.
- Mohan M, Prasad SR, Chellani HK, Kapani V. Intrauterine growth curves in North Indian babies: weight, length, head circumference and Ponderal index. *Indian Pediatr.* 1990; 27(1):43-51.
- Georgieff MK, Sasanow SR, Mammal MC, Pereira GR. Mid-arm circumference/head circumference ratio for identification of symptomatic LGA, AGA and SGA newborn infants. *J Pediatr* 1986; 109: 316-21.
- Brock RS, Falcao MC, Leone C. Body mass index values for newborns according to gestational age. *Nutr Hosp* 2008; 23(5):487-92.
- Undernourishment in the womb can lead to diminished potential and predispose infants to early death. Available at: <http://data.unicef.org/topic/nutrition/low-birthweight/>. Last accessed on 17th February, 2016.
- Low birth weight- Country, Region and Global Estimates. Available at http://data.unicef.org/wp-content/uploads/2015/12/low_birthweight_from_EY_1_07.pdf. Last accessed on 17th February, 2016.
- Lawn JE, Kerber K, Enweronu-Laryea C, Masee Bateman O. Newborn survival in low resource settings--are we delivering? *BJOG.* 2009; 116(1):49-59. doi: 10.1111/j.1471-0528.2009.02328.x.
- Miller HC, Hassanein K. Diagnosis of impaired fetal growth in newborn infants. *Pediatrics.* 1971; 48:511-522.
- Man Mohan, Shiv Prasad SR, Chellani HK, Kapani V. Intrauterine growth curves in North Indian babies: Weight, length, head circumference, Ponderal in dex. *Indian Pediatr.* 1990; 27:43-51.
- Meadow NJ, Till J, Leaf A. Screening for intrauterine growth retardation using ratio of midarm circumference to occipitofrontal circumference. *Br Med J.* 1986; 292:1039-1040.
- Kliegman RM. The fetus and the neonatal infant In: *Textbook of Pediatrics* Ed 15, Eds Nelson WE, Behrman RE, Kliegman RM, Arvin AM, WB Saunders Company, 1996, 453-454.
- Metcoff J. Clinical assessment of nutritional status at birth. Fetal malnutrition and SGA are not synonymous. *Pediatr Clin North AM.* 1994; 41:875-891
- Mehta S, Tondon A, Dua T, Kumari S, Singh SK. Clinical assessment of nutritional status at birth. *Indian Pediatr.* 1998; 35:432-428.