Original Research Article

CAN score- a boon to resource limited settings

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Abstract

Introduction: Fetal Malnutrition is one of the major determinants of neonatal outcomes, especially in under privileged communities. Assessment may be tedious, expensive and often eating into resources limiting its effective management. CAN scoring emerging as a promising simple and cost effective tool needs validation before wide spread adoption. **Materials and Methods:** We carried out a Prospective Study of 3 months duration between 1st November 2018 and 31st January 2019 at our Hospital, a tertiary care centre with neonatal intensive care unit (NICU) in South India. **Results:** Total number of newbornin our study was 104. The incidence of malnutrition according to CAN Score is 29.8%, Ponderal Index 12.5%, Weight for Gestational Age is 13.5% and Body Mass Index is 14.4%. The Sensitivity, Specificity and Positive Predictive Value of CANS are 83.87%, 79.45%, 63.41%, which are high and are statistically Significant. **Conclusion:** CAN Score appear to be a Simple and Cheap Tool to accurately assess Neonatal Malnutrition.

Keywords: Fetal malnutrition, CAN score, Ponderal index

Introduction

The term fetal malnutrition was coined by Scott and Usher in 1966 which is defined as soft tissue wasting at birth and failure to acquire quantum of fat & muscle mass during intrauterine growth [1]. The terms SGA, IUGR, LBW are not synonymous. Fetal malnutrition is a major determinant of Neonatal Outcomes especially in under privileged communities [2]. About 40% have Intellectual and Neurological handicap in the future.

The assessment of fetal malnutrition may be tedious, expensive and often eating into resources limiting its effective management. The common methods of assessment are based on Anthropometry, Proportional indices and Clinical assessment [3].

CAN scoring, a clinical assessment tool described by Metcoff has since its inception been tried with promising results with few studies in India, needing validation before wide spread adoption. [4-7] (figure 1). The aim of this study is to identify the incidence of fetal malnutrition and to compare CAN score with other assessment tools.

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Material and Methods

Setting: Department of Paediatrics, EPCMSRC, A tertiary care centre with NICU

Type of study: Prospective pilot study conducted for 3 months duration from 1st November 2018 to 31st January 2019

Sample collection: Patient records like Antenatal (ANC) cards, Delivery notes, Neonatal records and Inpatient case sheets. Anthropometric details measured were Birth weight and Length at time of birth. Ponderal index (PI), Body mass index (BMI), Weight for Gestational Age (GA) and CAN score were calculated as per standard formula, percentile chart and Metcoff chart respectively. CAN scoring was done by a single observer between 24 to 48 hours after birth.

Inclusion criteria

- All Consecutive Term > 37 weeks
- Delivered inborn

Exclusion Criteria

- Congenital anomalies
- Twins
- Preterm neonates

Statistical methods: Statistical analysis was done using Software MS Office and SPSS. The Statistical formulas were Pearson correlation coefficient r, Chi square test, screening validity. Sensitivity, specificity, positive and negative predictive value were calculated.

Ethical consideration: Institutional Ethics Clearance (IEC) approval was obtaine.

Results

The total number of newborns fulfilling the inclusion and exclusion criteria and included in the study was 104 (n=104). Of the analysed 104, 59 were female and 45 were male. There was a slight female preponderance which is statistically significant.

On analysis of the mothers it was found Primigravidae were 38, multipara (3 or >) were 31 with maternal age average 25.34 years, median 25 years and mode being 22 years. Mothers having history of previous abortions were 6 and previous child deaths were 5. Maternal illness noted was GDM in 16, PIH in 6, Hypothyroidism in 12.

Table-1: Comparison of proportional indices of various anthropometric measurements

Indices	Weight	Length	BMI	Ponderal index	CANS
MEAN	2.887	47.78	12.56	2.866	27.567
STDV	0.433	2.697	1.722	2.123	3.355
MEDIAN	2.900	48.00	12.75	2.640	28
1Q	2.650	46.00	11.60	2.440	25
3Q	3.215	50.00	13.61	2.900	30
MODE	3.400	50.00	12.80	2.700	29

When analyzing the total 104 newborns, the anthropometric details noted were mean birth weight of 2.88 kg (2.88^{+}_0.43), and length 47.79 cm (47.79^{+}_2.69). The proportional indices were BMI 12.56 (12.56^{+}_1.72) and PI 2.86 (2.86^{+}_2.12). The CAN score was 27.56 (27.56^{+}_3.35) (Table 1)

Table-2: Malnourished assessed by various tools

Parameter	Normal	Malnourished	Incidence
BW	87	17	16.3%
GA	90	14	13.5%
PI	91	13	12.5%
BMI	89	15	14.4%
CANS	73	31	29.8%

The data was analysed for fetal malnutrition with the predetermined cut offs and the results were as follows. Out of 104 neonates, 17 were of low birth weight (2.5kg) which is 16.3%. 14 were small for gestational age (13.5%). About 13 (12.5%) neonates had Ponderal index below 2.2, low BMI was seen in 15 babies (14.4%). Around 31 newborns were malnourished according to CAN scoring which is 29.8%. (Table 2)

Table-3: Chi Square Test

CAN	Ponderal index	BMI	Birth weight	Gestational age
73(86.00) [1.97]	91(86.00) [0.29]	89(86.00) [0.10]	87(86.00) [0.01]	90(86.00) [0.19]
31(18.00) [9.39]	13(18.00) [1.39]	15(18.00) [0.50]	17(18.00) [0.06]	14(18.00) [0.89]

The Chi Square statistic is 14.7804. The p- value is 0.005179.

Chi square test was performed and the assessment of malnutrition by CANS with other methods was statistically very significant, $p = 0.0051 (p<0.01)$. (Table 3)

Table-4: Sensitivity, specificity, predictive values and accuracy

Parameter	BW	GA	PI	BMI	CANS
Sensitivity	73.68	85.71	44.44	53.33	83.87
Specificity	80.00	78.89	71.58	74.16	79.45
PPV	45.16	38.17	12.90	25.81	63.41
NPV	93.15	97.26	93.15	90.41	92.06
Accuracy	78.85	79.81	69.23	71.15	80.77

Sensitivity, specificity and predictive values of each of the tools were calculated and compared (Table 4) CAN score had the highest accuracy of 80.77% with high sensitivity of 83.87%, specificity of 79.5%, positive predictive value of 63.41% and negative predictive value of 92.06%.

According to GA, accuracy is 79.81%, highest sensitivity of 85.71%, specificity of 78.89%, positive predictive value of 38.17% and highest negative predictive value of 92.06%. BW had an accuracy of 78.85% with sensitivity of 73.68%, specificity of 80%, and positive predictive value of 45.16% and negative predictive value of 93.15%.

According to PI, sensitivity of 44.44%, specificity of 71.58%, lowest positive predictive value of 12.9%, negative predictive value of 93.15% had lowest accuracy of 69.23%. BMI has a sensitivity of 53.33%, specificity of 74.16%, positive predictive value of 25.81%, negative predictive value of 90.41% and accuracy of 71.15%.

Discussion

Low birth weight is a major public health problem in India, incidence as high as 30%, whereas in developed countries it is only 5-7 % [1]. Fetal malnutrition defined by Scott & Usher in 1966 is a well established entity whose assessment can be done by various methods [2, 3].

A detailed knowledge of Fetal malnutrition is important to understand clinical problems, such as inutero growth restriction, fetal macrosomia and nutritional needs of the preterm infant. The growth of the fetus which is extremely rapid accounts for a significant fraction of the nutrients required by the fetus throughout gestation. Fetus is not a true parasite as it extracts only 2-4 % of the nutrients reaching it from the placenta whereas 96% to 98% being returned to the placenta and maternal circulation [8]. Nutrition of the fetus depends on extraction, nutrient composition of the umbilical blood, flow rate and the capacity to utilize the extracted nutrients [9].

The classification systems for intrauterine growth retarded babies mostly are based on observed birth weight below the 3rd or 10th percentile for gestational age using various growth curves [10]. But none of the described classification system identifies fetal malnutrition. Fetal malnutrition is a term coined by Scott and Usher, which indicates a clinical state that may be present irrespective of birth weight, gestational age (AGA), intrauterine growth retardation (IUGR) or small for gestational age (SGA) categories [1].

The clinical manifestations of fetal malnutrition depend in part on when it began during gestation [10] Malnutrition beginning early in the second trimester-length, head circumference and weight are significantly reduced.

a) Malnutrition beginning early in the third trimester– length and head circumference are less affected, but are small and underweight with some loss of subcutaneous tissues and muscle.

b) Malnutrition– late in the third trimester-significantly underweight for gestational age with obvious loss of subcutaneous tissue, but with length and head circumference within normal range.

CAN scoring is the clinical assessment of nutrition described by Metcoff in 1994 to detect the fetal malnutrition done by readily detectable superficial signs. There are 9 clinical signs with eachscored from 1 to 4, total ranging from 9 to 36. The clinical presentation of fetal malnutrition varies based on the timing of gestation, while other anthropometric measurements may or may not be affected [5]. CAN score is advantageous to assess fetal malnutrition as it can most accurately measure subcutaneous fat and malnutrition as compared to other tools, it doesn't need any special equipment or formula to calculate and it is a good clinical index for predicting the neuro developmental outcome of infants with fetal malnutrition [3,7]. Scores less than or equal to 24 are taken as clinical evidence of malnutrition, which is occurring in utero i.e. Fetal Malnutrition [5].

In his study, Jack Metcoff observed that 95% of AGA babies had a score greater than 24. More than 54% of SGA babies were malnourished, but 46% SGA babies had a score greater than 24. 5.5% AGA babies were fully grown but were malnourished. A large error in classification would occur if SGA or IUGR were considered synonymous with fetal malnutrition and if all AGA babies were considered adequately nourished.

Man Mohan et al 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. When CAN score was compared with Ponderal Index it gave a sensitivity of 44.44% and specificity of 71.58% in the present study.

The incidence of fetal malnutrition by CAN scoring in our study is 29.8% and the significant difference noted when compared to other tools of assessment in our study is similar to other studies, reemphasizing the importance of differentiating fetal malnutrition from SGA, IUGR [2-7]. Also CAN score have high accuracy and sensitivity and specificity when compared to other tools. This is similar to findings of previous studies [3, 7].

The incidence of fetal malnutrition in our study is 29.8%. Incidence of FM according to various other Indian studies are Soundarya et al is 24%, Abhaykumar Dhanorkar et all [12] is 32.29% ,Vikram Singhal et al [2] is17.5%, Naveen Sankhyan et al [13] diagnosed 27.97% malnourished neonates and Adebami et al [14] detected 18.8 % malnutrition by CANSCORE.

Higher percentage of FM in some studies may be explained by low socio economic condition of the mothers. According to Metcoff study, incidence was only 10.9%, since this study was done in a developed country.

A total of 13 babies had a ponderal index < 2.2 and sensitivity of PI in detecting FM was low (44.44%). Cole TJ et al [17] found that the Ponderal index is not appropriate for measuring intrauterine malnutrition, as it fails to adjust for length at all gestations. About 16.3% were malnourished according to birth weight measurements which accounts for 73.68% sensitivity which is much less than CANS scoring (83.87%).

If we consider weight as the only criteria for assessing nutritional status, there is probability of missing malnourished babies in AGA category and over diagnosing well nourished babies in SGA category. In Conclusion, fetal malnutrition as assessed by CAN score is nearly 30% as compared to all other tools around 15%. CAN Score has the highest accuracy with high sensitivity, specificity and negative predictive value. Limitations of our study are as follows. It is a hospital based pilot study with a small sample size. We have not excluded newborns of mothers with illnesses unlike some other studies.

What this studyadds to existing knowledge?

The broad understanding and lessons learnt from this study is that Fetal malnutrition is grossly inadequately assessed in our country though it impacts paediatric health. CAN score is a simple and cost effective tool and should be promoted for wide spread adoption.

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