A SIMPLE SCREENING-TOOL FOR FETAL-MALNUTRITION AT BIRTH: A COMPARATIVE STUDY OF CLINICAL ASSESSMENT OF NUTRITIONAL STATUS (CANS) VERSUS OTHERS

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ABSTRACT: INTRODUCTION: India has higher incidence of low birth weight as compared to any other developed country in the world. Also the sequelae of low birth weight like morbidity and mortality due to lack of early identification and treatment is a major problem throughout India. Hence, this study was conducted in Mysore Medical College & Research Institute, Mysore with objective of assessing the fetal malnutrition (FM) in term newborns using Clinical assessment of nutritional status (CANS) and comparing with other available methods. **MATERIALS AND METHODS:** A cross-sectional study was conducted using 225 full-term neonates delivered at MMC & RI, Mysore, over one month period of June 2013. Birth weight, length, mid arm circumference (MAC) and head circumference (HC) were recorded in the newborns. Ponderal index (PI), wt/GA, MAC: HC ratio and MAC were calculated. Clinical assessment of nutritional status was done on the basis of CANS score and compared with other methods. **RESULTS:** Total 225 neonates studied with male: female ratio of 1.1:1. CANS found 45.7% (103) neonates with FM. Wt/GA was more sensitive (98.06%) and correlating statistically ($p=0.000$) with FM detected by CANS. FM detected by PI, MAC: HC ratio and MAC were less correlating and less sensitive to that of CANS (sensitivities=86.40%, 51.45%, and 50.48% respectively). **CONCLUSION:** Clinical assessment of nutritional status (CANS) being a simple clinical-tool, can detect fetal-malnutrition (FM) without aid of any sophisticated-equipment in term-neonates which are missed by other methods. CANS can be used as a screening-tool in resource-limited settings of India effectively.

KEYWORDS: CANS, fetal malnutrition, ponderal index, IUGR, SGA.

INTRODUCTION: The incidence of low birth weight (<2500 grams) is still high in India (30%), as compared to the developed countries (5-7%). It is critical to screen and intervene early because of its high mortality and long term sequelae in neonates. Fetal malnutrition (FM) is a clinical state of obvious intrauterine loss or failure to acquire normal amounts of subcutaneous fat and muscles (first described by Scott and Usher).

MATERIALS AND METHODS: Our study was a simple cross sectional study, done over one month period of June-2013 and included 225 full term neonates, delivered at Cheluvamba Hospital attached to MMC&RI, Mysore.

Inclusion Criteria:

- Live born singleton neonates with >35 weeks gestational age (GA).
- Known GA (LMP, new Ballard score or Obstetrical ultrasound if done).
- No major congenital malformations.

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All babies born in the study period were weighed with electronic weighing machine and weight was recorded. Other anthropometric assessments were done at 24-48 hour of life. Length of each baby was measured using infantometer. Mid arm circumference (MAC) was measured with the help of a non-stretchable tape on left arm. Head circumference was recorded. CAN scoring was done for each baby.

Based on standard intrauterine-growth-curves (Wt/GA), neonates were classified into small and appropriate for gestational age (SGA, AGA respectively). Weight for gestational age (wt/GA) was estimated for each baby in terms of SGA or AGA using standard intrauterine growth curves. Ponderal index was calculated using formula $[\text{weight (grams)}/\text{Length (cm)}^3 \times 100]$. Values of <2.2 were taken as intrauterine growth retardation (IUGR). MAC/HC ratio <0.27 was taken as FM. MAC value $<8.6\text{cm}$ was taken as FM. CANS (FM if <25 score) was considered standard and compared with other methods.

Data was analyzed with statistical package for social sciences program version 16.0 (SPSS-16). P value of less than 0.05 is considered to be statistically significant. Observations were statistically analyzed. FM in term-newborns detected by CANS were compared with each of other methods (Wt/GA, PI, MAC/HC and MAC). The sensitivity, specificity, positive and negative predictive values were determined for the various anthropometric criteria, by using CAN score value below 25 as the definition of fetal malnutrition (FM).

RESULTS: Out of 225 babies with sex ratio of 1.1:1, CAN scoring identified 103 babies (45.7%) as having fetal malnutrition (FM) and 122 (54.3%) as not with FM. Babies analyzed with wt/GA using standard charts, two were not identified as having small for gestational age (SGA) which were identified as having FM by CANS. Ponderal index (PI) could identify only 89 babies as having IUGR out of babies who were screened to be having FM by CANS. MAC: HC ratio identified only 53(51.5%) babies as having FM out of 103 babies of FM screened by CANS. MAC found only 52(50.48%) babies as having FM out of 103 babies with FM screened by CANS.

If we considered CANS as a standard tool to screen for FM, all other methods could not overtake or equate the fetal malnutrition detection rate of CANS.

Sensitivity of other methods, with CANS as standard were 86.4% for PI, 51.445% for MAC: HC ratio and 50.48% for MAC. Out of them Wt/GA was more sensitive to detect FM in terms of SGA and correlated well with CAN score with statistical significance ($p<0.01$).

DISCUSSION: There is high incidence of LBW in India (30%) compared to developed countries (5-7%). Only 10% LBW babies are preterm and remaining being term IUGR babies. These babies have high incidence of neonatal morbidity and long term sequelae.^{1, 2}

This study was done to compare the available methods to identify fetal malnutrition so that, they can be applied as a screening tool in low resource settings:

- Fetal malnutrition (FM) is defined as a clinical state of obvious intrauterine loss or failure to acquire normal amounts of subcutaneous fat and muscles by Scott and Usher.
- Intrauterine growth retardation (IUGR) represents deviation and reduction in the expected fetal growth pattern and it complicates about 5% to 8% of all pregnancies. A fetus with IUGR may be born small for gestational age (SGA) or appropriate for gestational age (AGA) according to population reference charts.

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- Small for gestational age (SGA) means weight below the 10th percentile (Battaglia and Lubchenco, 1967; Alexander et al, 1996). Appropriate for GA (AGA) means, weight between 10-90th %^{le}.

CAN score is based on superficial, readily detectable signs of FM (Metcoff). There are total 9 signs.³ Each sign is rated 1 (worst or severe FM) to 4 (best or well nourished). Lowest score=9; highest attainable score=36. When CANS is <25=FM. (Fig. 1)

- Wt/GA May not be entirely accurate in detecting SGA because, it may identify many well-nourished neonates as SGA, or miss a proportion of malnourished AGA neonates. Similar results were obtained by Mehta S et al., Singhal V et.al. and Sankyan N et al. ^{4,5} (table 1)
- PI relies on the principle that length is spared at the expense of weight during period of acute malnutrition. But it could not identify all cases of FM detected by CANS as having IUGR. Similar results were obtained by Sankyan N et al.⁵ (table 2)
- MAC: HC ratio is used as a reliable test to identify neonates with growth retardation even when wt. doesn't fall <10th %^{le}; but those babies whose HC is decreased because of proportionate growth retardation might not be identified; hence the low detection rate of FM in our study is justified. Similar results were obtained by Mehta S et al., Sharma JNet.al., and Golebiowska M et.al. ^{6,7,8} (table 3)
- Even MAC alone could not screen all FM babies and was not much sensitive.⁹
- Evaluation of fat-deposits is an appropriate means for distinction between IUGR and non-IUGR—hence the accuracy of CANS in screening for high risk FM babies is justified, whose sensitivity in our study is more than other methods used.

Hence, CANS scoring being a simple clinical-tool, can detect FM without aid of any sophisticated-equipment in term-neonates which are missed by other methods and can be used as a screening-tool in resource-limited settings of India effectively. Limitations of our study were: a small sample size and needed further larger sample size. Risk factors for IUGR were not included in the study, which may contribute to the conclusions.

CONCLUSION: CANS being a simple clinical-tool, can detect FM without aid of any sophisticated-equipment in term-neonates which are missed by other methods.

CANS can be used as a screening-tool in resource-limited settings of India effectively.

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Figure 1: Clinical assessment of nutritional status in the newborn

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		CANS		Total	P value
		FM	No FM		
Wt/GA	SGA	101(98%)	2(1.6%)	103	0.000
	AGA	2(2%)	120(98.4%)	122	
Total		103(100%)	122(100%)	225(100%)	

Table 1: Comparison of CANS with Wt/GA

		CANS		Total	P value
		FM	No FM		
PI	IUGR	89(86.4%)	2(1.6%)	91	0.000
	No IUGR	14(13.6%)	120(98.4%)	134	
Total		103(100%)	122(100%)	225(100%)	

Table 2: comparison of CANS with PI

		CANS		Total	P value
		FM	No FM		
MAC/HC ratio	FM	53(51.5%)	3(2.5%)	56	0.000
	No FM	50(48.5%)	119(97.5%)	169	
Total		103(100%)	122(100%)	225(100%)	

Table 3: Comparison of CANS with MAC: HC ratio

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