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Clinical Assessment of Foetal Malnutrition Using 'CAN Score' in Full Term Neonates

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Introduction

Foetal malnutrition (FM) is the failure to acquire adequate quantum of fat and muscle mass during intrauterine growth. Foetal malnutrition (FM) is a term coined by Scott and Usher in 1966 to describe infants who showed evidence of soft tissue wasting at birth irrespective of the specific aetiology [1]. This is not synonymous with either small for gestational age (SGA) or Intrauterine growth Restriction (IUGR). In Foetal malnutrition, the subcutaneous tissues and underlying muscles are diminished and the skin of arms, legs, elbows, knees and interscapular regions is very loose. In severe FM, the neonate may look 'emaciated' or 'marasmic' as the skin appears 'several sizes' too large for the baby. The assessment of nutrition at birth has been made using various systems.

A simple, practical, clinically applicable scoring system CANS (Clinical Assessment of Nutritional Score) was developed by Metcoff [2]. It was developed to differentiate malnutrition from appropriately nourished babies, irrespective of birth weight.

It is based on nine 'superficial' readily detectable signs of malnutrition in the newborn baby. Anthropometric parameters like length, weight, and head circumference have also been used to assess the occurrence of fetal malnutrition.

The importance of addressing this hidden problem of fetal malnutrition is emphasized because of the potentially serious sequel of malnutrition on multiple organ systems with studies showing that 39% of fatally malnourished babies had intellectual and neurological handicaps, whether Appropriate for Gestational Age (AGA) or Small for Gestational Age (SGA) [3, 4].

Hence, it is the need of the hour to promptly identify newborns with FM.

Objectives

1. To estimate occurrence of fetal malnutrition in full term neonates using "CAN SCORE"
2. To compare CAN Score with other anthropometric criterion used to assess foetal growth.

Materials and Medhods

Study Type

It is a cross sectional study.

Study Area

The study was undertaken in NKP Salve Institute of Medical Sciences & Research Centre & Lata Mangeshkar Hospital, Nagpur.

Study Group

The study group included 60 live, single, full term neonates and the duration of the study was 2 months. After obtaining an informed consent from parents, clinical assessment of nutrition and anthropometric evaluation was carried out and entered into the pro forma.

Inclusion Criteria

1. Live born, singleton term infants
2. Infants whose hospital stay exceeds 24 hr.
3. Infants with Gestational age >37 weeks
4. Parents willing to give informed consent

Exclusion Criteria

1. Babies with obvious congenital malformation
2. Pre-term newbornsPost-term newborns
3. All observations were made in a warm and well-lighted room.

CAN Score was obtained on the basis of 9 superficial readily detectable signs of malnutrition in new born as described by Metcoff [2]. Each clinical sign of CAN Score was rated from 1(severe FM) to 4 (well nourished). The highest attainable score was 36 and the lowest was 9.Foetal malnutrition was concluded in those with a CAN Score of less than 25.

Signs for clinical assessment of nutritional status in newborn

1. **Hair**– Large amount, smooth, silky, easily groomed [4]. Thinner, some straight, "staring" hair [3]. Still thinner, more straight, "staring" hair which does not respond to brushing [2].

Straight "staring" hair with de pigmented stripe (flag sign) [1].

2. **Cheeks**–Progression from full buccal pads and round face (4), to significantly reduced buccal fat with narrow, flat face [1].

3**. Neck and Chin–**Double or triple chin fat fold, neck not evident (4); to thin chin. No fat fold, neck with loose, wrinkled skin, very evident [1].

4. **Arms–**Full, round, cannot elicit "accordion" folds or lift folds of skin from elbow or tricep area [4]; to a striking "accordion" folding of lower arm, elicited when examiner's thumb and fingers of the left hand grasp the arm just below the elbow of the baby and thumb and fingers of the examiners right hand circling the wrist of the baby are moved towards each other; skin is loose and easily grasped and pulled away from the elbow.

5. **Legs**– Full, round, cannot elicit "accordion" folds or lift folds of skin [4]; to a striking "accordion" folding of lower leg, elicited when examiner's thumb and fingers of the left hand grasp the leg just below the ankle of the baby and thumb and fingers of the examiners right hand circling the knee of the baby are moved towards each other; skin is loose and easily grasped and pulled away from the knee.

6**. Back**–Difficult to grasp and lift skin in the inter-scapular area[4]; to skin loose, easily lifted in a thin fold from the inter scapular area [1].

7**. Buttocks**–Full round gluteal fat pads [4]; to virtually no evident gluteal fat and skin of the buttocks and upper posterior high loose and deeply wrinkled [1].

8. **Chest**–Full, round, ribs not seen [4]; to progressively prominence of the ribs with obvious loss of inter costal tissues [1].

9**. Abdomen**–Full, round, no loose skin [4]; distended or scaphoid, but with very loose skin, easily lifted, wrinkled and "accordion" folds demonstrable.

Gestational age assessment was based on accurate recollection of date of last menstrual period by the mother and if a doubt exists, findings from recent ultrasound examination were taken into consideration and assessment of new born using Expanded New Ballard score was used to assign gestational age in completed weeks.

Weight was obtained by using digital scale with a capacity of 20kgs, and sensitivity of $\pm$ 5gm.

Head Circumference was measured with a non stretchable measuring tape just above the supra orbital prominence anteriorly and over the maximum occipital prominence posteriorly excluding the ears. Care was taken that the tape passed around the head at the same level on each side.

Length was measured using an infantometer. A slight pressure was applied at newborn's knees to ensure full extension of lower extremities.

Ponderal Index was calculated by using the formulae:

$$PI = \frac{\text{Weight} \times 100}{(\text{Height})^3}$$

(where weight is taken in grams and height in centimeters)

All the newborns were broadly classified into various categories of malnutrition using the standards of Weight, Length, Ponderal index and Head circumference.

The obtained anthropometric parameters were compared to CAN Score and helped identify the method that was more useful in assessing fetal malnutrition. Then various types of malnutrition were compared with CAN SCORE viz. Weight, length, PI, Head circumference Vs CAN SCORE.

Observation and Results

Out of 60 neonates 33 neonates were male and 27 neonates were female.

Total numbers of neonates tested were 60. Out of these 60 neonates, 7 had foetal malnutrition by CAN SCORE. Thus, the percentage of neonatal malnutrition in this study is 11.6% when CAN SCORE was used .

Out of 33 male neonates, 4 had foetal malnutrition with 12.1%. Foetal Malnutrition amongst male when CAN SCORE was used. Similarly amongst female, the percentage of foetal malnutrition was 11.1%. No significant difference was found between male and female malnourished children. The rate of malnourishment was found to be almost similar in both the genders.

When foetal malnutrition by CAN SCORE was compared with birth weight of neonates, it was found that 15 neonates had wt< 2.5 kg and those with normal birth, weight were 45 neonates. Out of those foetally malnourished by CAN SCORE 6 had birth weight < 2.5 . There was a significant correlation between neonates classified as malnourished by CAN SCORE and by birth weight. (p value < 0.001)

When foetal malnutrition was compared with Ponderal Index 48 had Ponderal index less then 2.5. All those who were classified foetally malnourished by CAN SCORE had Ponderal Index <2.5 .

When malnutrition was compared with length 9 had length < 46.3cm and were classified foetally malnourished. Out of 7 who had foetal malnutrition by CAN SCORE 5 had length less than 46.3cm. A significant correlation was found out between neonates classified malnourished by CAN SCORE and length (p <0.001).

When Head circumference was compared **8** Head circumference were less than 32.1cm. Out of those who had foetal malnutrition by CAN SCORE, **3** head circumference were less then 32.1cm. A significant correlation was found out between neonates classified malnourished by Head circumference and by CAN SCORE (p< 0.001).

Table 1

	Male	Female	Total
Total Population	33	27	60
Foetal Malnutrition by CAN SCORE	4(12.1%)	3(11.1%)	7(11.6%)

Discussion

Table 2

	Wt<2.5	Wt> 2.5	Total
Normal Neonates by CAN SCORE	9	44	53
Foetal Malnutrition by CAN SCORE	6	1	7
Total	15	45	60

The clinical manifestation of foetal malnutrition depend in part when it began during gestation . Babies whose length, head circumference and weight are significantly reduced probably were exposed to malnutrition beginning early in the first trimester. Those whose length and head circumference are less affected but are small and underweight with some loss of subcutaneous tissue and muscle probably became malnourished beginning early in the third trimester. For babies who are significantly

Table 3

	PI<2	PI 2–2.5	P.I ≥2.5	Total
Normal neonates by CAN SCORE	12	30	11	53
Foetal Malnutrition by CAN SCORE	1	6	Nil	7
Total	13	35	12	60

Table 4

	Length < 46.3cm	Length >46.3cm	Total
Normal Neonates by CAN SCORE	4	49	53
Foetal Malnutrition by CAN SCORE	5	2	7
Total	9	51	60

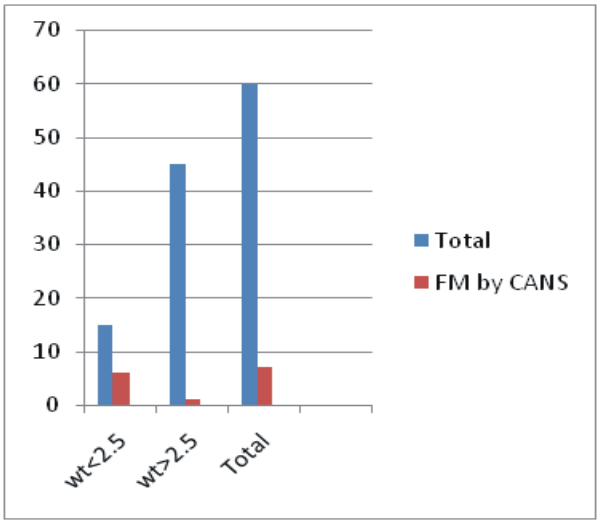
underweight with obvious loss of subcutaneous tissue , but with length and head circumference within the normal range, an insufficient or unbalanced nutrient supply most likely occurred in late third trimester.

Table 5

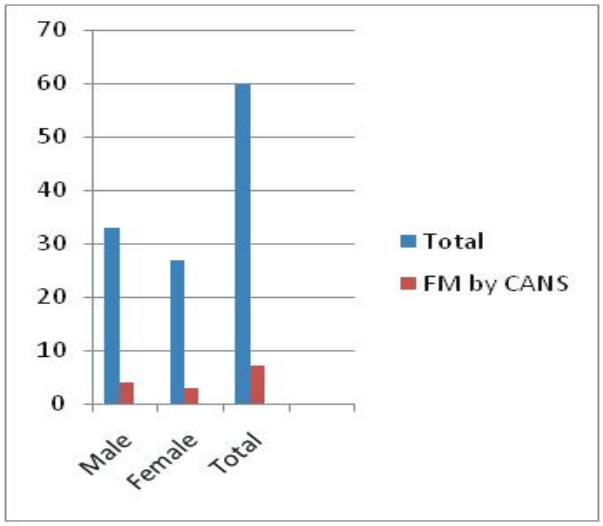
	H.C<32.1cm	H.C > 32.1cm	Total
Normal Neonates by CANSCORE	5	48	53
Foetal Malnutrition by CAN SCORE	3	4	7
Total	8	52	60

In foetally malnourished infants, the subcutaneous tissue and underlying muscle mass are diminished. The skin appear too large for the baby at several sites. Buccal and buttock fat pads are reduced and scalp hair may be coarse, patchy, or 'straight'.

Graph 1



Graph 2



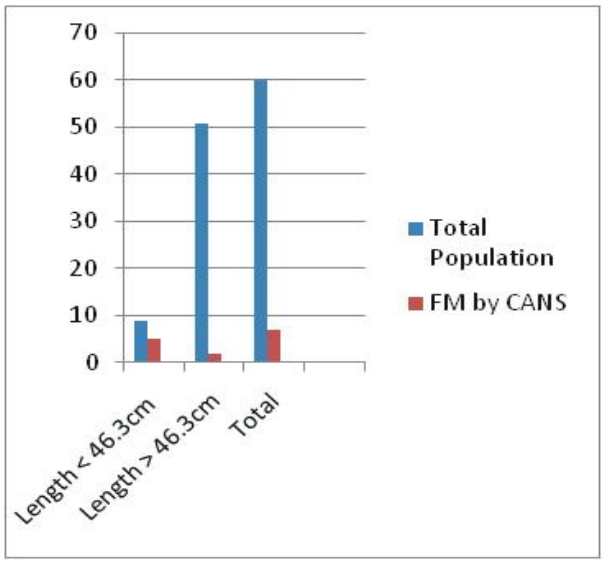
In this study consisting of 60 newborns which included 33male and 27 female, the percentage of foetal malnutrition was 11.6% when CAN SCORE was used. Previous studies have also revealed foetal malnutrition of about 10% (Usher) [1] and 10.9% (Metcoff) [2].

In this study it was found out that almost all the babies who had foetal malnutrition by CAN SCORE had birth weight < 2.5 kg. In this study, total 15 babies were having weight <2.5kg.

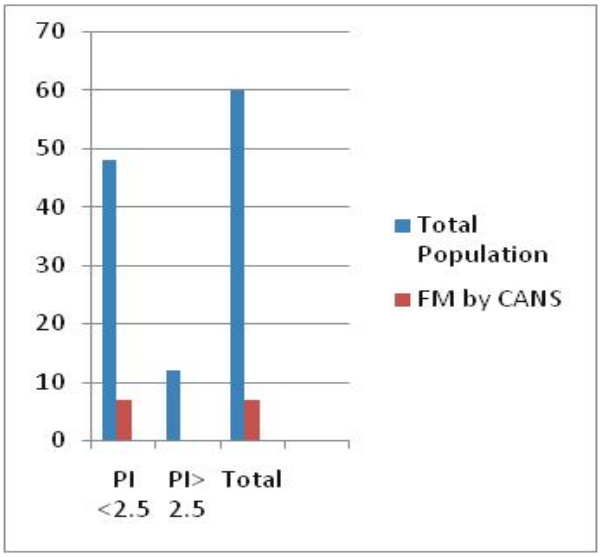
When correlated with Ponderal Index; all the patients with foetal malnutrition had Ponderal Index of <2.5 which implies that the babies who were having foetal malnutrition were either malnourished or hypoplastic on Ponderal Index. In this study out of 48 patients having foetal malnutrition by Ponderal Index, 7 were actually malnourished by CAN SCORE.

When other anthropometric criterion were used like Length, Head circumference and it was found out that out of 7 who had foetal malnutrition by CAN SCORE, 5 had length less than 46.3cm. A

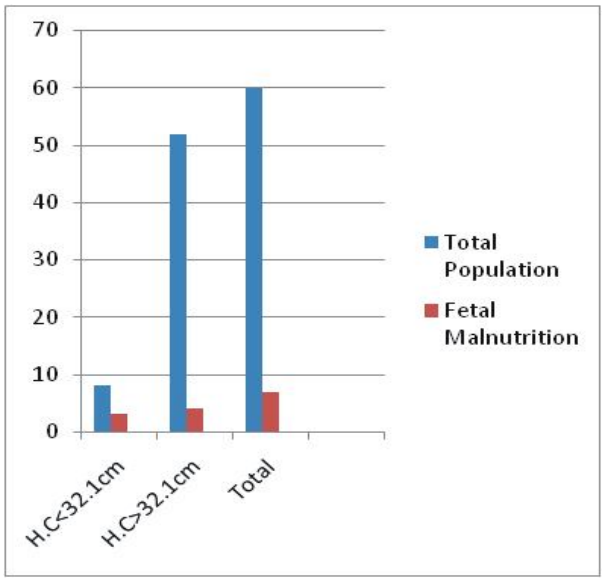
Graph 3



Graph 4



Graph 5



significant correlation was found out between neonates classified malnourished by CAN SCORE and length and when Head Circumference was compared, 8 Head circumference were less than 32.1cm. Out of those who had fetal malnutrition by CAN SCORE, 3 head circumference were less than 32.1cm. A significant correlation was found out between neonates classified malnourished by Head Circumference and by CAN SCORE .

Summary & Conclusion

In the present study with sample of 60 neonates, a simple brief clinical assessment of Nutritional Status (CAN SCORE) revealed, 7 neonates were foetally malnourished. Most of the newborns of weight <2.5kg were foetally malnourished .

In this study CAN SCORE detected 11.6 % of the full term neonates as foetally malnourished CAN Score is a simple technique. It does not require the use of any sophisticated equipments for assessment of foetal malnutrition. It is easy to carry out as the score contains the examination for nine clinical signs viz. hair, cheeks, neck, arms, chest, skin of abdominal wall (or abdomen), back, buttocks and legs. The score assess nutritional status of the foetus at birth. Features of foetal malnutrition are sought for each baby using nine 'superficial' readily detectable signs. The advantage of CAN SCORE is that it is a simple, clinical index for identifying foetal malnutrition and thus it may have the potential to predict neonatal morbidity associated with foetal malnutrition without the aid of any sophisticated equipments.

Out of 22 million Low Birth weight babies, 21 million are born in developing countries. Large number of low birth weight babies are foetally malnourished. Thus, with the help of CAN SCORE which is used for detection of a significant number of foetally malnourished newborns can be done easily.

Assessment of nutritional status of foetus is a major concern to clinician because of potentially serious sequelae of malnutrition on Multiple Organ Systems therefore, there is a need for prompt identification of babies with foetal malnutrition. CAN Score is a simple clinically applicable scoring system for

detection of Foetal Malnutrition at birth irrespective of birth weight and gestational age.

If foetal malnutrition might be prevented or corrected, millions of babies worldwide would be spared of various squeal of malnutrition and cardiovascular risk factor, metabolic problems and various neurological problems later in life.

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