Looking for the Best Indicator Fetal Malnutrition: An Overview

O Aderinsola, A Joseph

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Abstract

In this paper we discuss the common methods available for identification of the malnourished fetuses at birth. We recommend that the CANS and the based CANSCORE which is purely clinical be routinely used. This will remove the bias caused by birthweight which vary from one region to another. Features of malnutrition are the same whether in Nigerians, Americans or Indians.

INTRODUCTION

Assessment of nutritional status of fetus has been a major concern to many clinicians because of the potentially serious sequelae of malnutrition on multiple organ systems.[1,2] Various methods have been used to identify malnourished fetuses as early as possible. There is no consensus among experts with regard to which terminologies to be adopted; and the reliability, reproducibility, sensitivity, specificity and the ease of performing assessment of the nutritional status of the babies at birth.[1,2] The use of different terminologies to describe the same problem is prone to misunderstanding and misinterpretation of findings. Perinatal problems and/or long term central nervous system sequelae are known to occur primarily in babies with fetal malnutrition (FM) whether appropriate for gestational age (AGA) or SGA but not less so among those who are SGA but without fetal malnourition.[3] There is a need for prompt identification of babies with FM. Features of malnutrition must therefore be sought for, appropriately diagnosed and treated in every baby at risk. This anticipatory management of such infants at birth may decrease morbidity and improve the survival of such infants.[3,4,5,6,7]

The existing terminologies for describing intrauterine malnutrition include: small for gestational age (SGA), intrauterine growth retardation (IUGR), placental dysfunction /insufficiency, postmaturity, dysmaturity or pseudo-prematurity. None of these terminologies is actually synonymous with FM.[3,4]

FETAL MALNUTRITION

Fetal malnutrition (FM) is defined as failure to acquire adequate quantum of fat and muscle mass during intrauterine growth.[3,5] It is a term coined by Scott and Usher[4] to describe infants who show evidence of soft tissue wasting at birth irrespective of the specific aetiology[6] and it is independent of birth weight and gestational age.[3,4,5,6,7] It is not synonymous with either small for gestational age (SGA), (birth weight below 10th percentile for gestational age on the intrauterine growth chart)[8] or intrauterine growth restriction (IUGR). In FM, 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 decreased subcutaneous fat and muscle are evident by more quantitative measures such as upper arm circumference, triceps and interscapular skin fold measurements with estimate of arm muscle area. Buccal and buttock fat pads are reduced and the scalp hair may be coarse, patchy, or “straight and starring” as in marasmus or even have a “Flag-Sign” as in severe protein-calorie malnutrition (Kwashiorkor). Fetal malnutrition is therefore, also a clinical diagnosis. Babies who show evidence of muscular wasting should therefore be labeled appropriately.

SMALL FOR GESTATIONAL AGE

Small for gestational age (SGA) is a common terminology used synonymously with fetal malnutrition. In an SGA baby or a baby with intrauterine growth restriction (IUGR) the birth weight is below 10th percentile for gestational age on

the intrauterine growth chart[8]. However an SGA baby may or may not have suffered from intrauterine growth restriction [IUGR][5] and not all SGA babies have features of fetal malnutrition.[3,5,9,10] Since the diagnosis of SGA is usually made based on the use of a pre-determined intrauterine growth chart, some babies with FM who are not SGA will be missed using this traditional classification system.

The intrauterine growth standard for a given population just identifies babies whose birthweights are below the 10th percentile line in that population. It identifies 10 percent of that population. It is therefore unlikely to be sensitive and consistent in identifying or describing infants with wasting or FM. This is particularly true if local standards are not used because average birthweights vary in different communities. A baby whose birthweight falls above the 10th centile on a chart constructed for a particular community may be below the 10th centile in another chart constructed for a different population. Fetal malnutrition (FM), which is independent of intrauterine growth charts should therefore be preferred.

INTRAUTERINE GROWTH RESTRICTION (IUGR)

The term IUGR denotes an abnormal situation with reduction of growth, a downward inflexion from the normally steady progression.[9] It may not be associated with wasting. This is again sometimes used synonymously with SGA. Like the term SGA, it is therefore an arbitrary categorization of all babies estimated to be below the 10th percentile for gestational age on the intrauterine growth chart. This term is highly misleading, because in any normal population of fetuses, some 10% will by definition have a weight below the 10th percentile. Therefore, IUGR is better restricted to those fetuses where there is definite evidence that growth has faltered.[8] A fetus whose weight has fallen from the 90th percentile to the 30th in a short time is almost certainly in greater peril than a fetus who has maintained a position on the 5th percentile.

OTHER TERMINOLOGIES

Various proportionality indices have been used to relate different dimensions of fetal growth, particularly among growth-retarded infants.[10,11] The most commonly used of these is Rohrer's ponderal index [PI], which is defined as 100 times the birth weight (in grams) divided by the cube of birth length (cm^3). Some authorities classify normal ponderal index as 2.32-2.85g/cm^3; greater than 2.85 as obese and less than 2.32 as thin.[12] Infants with high ponderal indices are relatively heavy for length (or equivalently, relatively short for weight), while those who have low ponderal indices are thin and have low weight for length.

Growth inhibition early in gestation (e.g. mitotic arrest) would produce an undersized fetus with fewer cell numbers but normal “cell” size. Length would be affected as well as weight, producing a short-for-dates infants or symmetric IUGR. This pattern would be reflected in a normal ponderal index.[1] Whereas, later growth insults would have less effect on total cell number and fetal length but would result in decreased weight and “cell” size. These infants would be long and thin or light for dates, or would demonstrate asymmetric IUGR and low ponderal indices. The concept of proportionate type 1, symmetrical or stunted IUGR with normal ponderal index is unlike disproportionate, type 2 asymmetric or wasted IUGR with low ponderal index.[11,13,14,15,16] Therefore Rohrer's ponderal index may be used to distinguish the type of the growth retardation and can be of prognostic value. An increased risk of postnatal morbidity was demonstrated in infants with growth retardation and low ponderal index (LPI) compared with the similar group with normal ponderal index (NPI).[13]

Other proportionality indices that relate head circumference to length, chest circumference or mid arm circumference and/or mid arm circumference to head circumference [MAC:HC] have also been studied.[17,18,19] An infant who is classified as IUGR based on proportionalities may or may not be classified as SGA[3] and likewise may not have FM. Intrauterine growth restriction based on proportionalities may therefore not adequately describing fetal wasting or FM.

PLACENTAL DYSFUNCTION / INSUFFICIENCY (PD)

Placental dysfunction/insufficiency is used to describe a state of fetal compromise whether manifested during pregnancy or at time of labour.[20]Many problems related to pregnancy have been associated with PD ranging from IUGR, pregnancy induced hypertension, gestational diabetes, Rh-factor incompatibility, intrapartum fetal distress and postmaturity. It is classified into chronic PD (during pregnancy), sub-acute (pre-labour) and acute (during labour).[21] Placental dysfunction is therefore non-specific and a baby who suffered from PD, especially the acute type, may not have FM. It is therefore, not synonymous with FM and cannot be an appropriate term to describe fetal wasting or FM.

POSTMATURITY

This refers to a condition in which a fetus has a prolonged period of gestation of more than 42 completed weeks counting from the first day of last menstrual period. Many of these babies may show effects of impairment of nutritional supply perhaps from an aging process of the placenta. They may have suffered actual loss of weight in-utero with scaly and parchment-like skin. However, many post-term babies do not suffer placenta inadequacy but continue to grow and gain weight.[22] Also, a baby may have features of malnutrition without being post term. The term post maturity has therefore been dropped in describing fetal wasting.[6]

DYSMATURITY

The Scottish obstetrician, Ballantyne in 1902 was the first to call attention to dysmaturity when he described the dry, parched skin, the paucity of amniotic fluid, the presence of meconium in amniotic fluid and the advanced ossification in the skull of these babies.[23] Other authors at various times had also written on the subject of dysmaturity. These include Bossi in 1907, Bäcker 1915, Runge 1939, 1942, 1948, Taylor et al, 1952 and Clifford[23,24] 1945, 1951, 1953, 1954 and 1957. Sjöstedts et al in 1957 in Sweden also described infants who show evidence of wasting, scaling and parchment- like skin as dysmature.[24]

Dysmaturity is also sometimes used synonymously with placental insufficiency syndrome, postmaturity, SGA or IUGR. Clifford in 1945 also considered babies with obvious malnutrition as dysmature.[23]He further grouped the babies into 4 stages i.e. stages 0-3. Babies in stage 0 were normal babies without signs of dysmaturity. Babies with cracked, parchment-like and peeling skin with arms and legs also thin were in stage 1 while infants who exhibited the signs in stage 1 in a very marked degree were grouped into stage 2. Stage 3 refers to babies whose trunk and extremities were strikingly thin with a rather pronounced dystrophic appearance. The skin peels off in large flakes, the nail and the skin are yellow in colour. However, a fetus with FM may not show gross features of dysmaturity and his malnutrition may therefore be missed. Many studies on the subject of fetal wasting adopted the terminology of FM.[3,4,5,6,7] There is, therefore, need to adopt a suitable common terminology which will be self-explanatory, consistent and easily understood. It should not be ambiguous, confusing with different interpretation. This will allow the results of works to be compared. Dysmaturity suffers from the above shortcomings.

CLINICAL ASSESSMENT OF NUTRITIONAL STATUS [CANS] OF THE FETUS AND THE SCORE [CANSCORE]

In Clinical Assessment of Nutritional Status [CANS] of the fetus and the score [CANSCORE] fetal malnutrition (FM) is assessed and scored at birth. Features of FM are sought for in each baby using nine ‘superficial' readily detectable signs as described by Metcoff.[4]Maximum score of 4 is awarded to each parameter with no evidence of malnutrition and lowest of 1 is awarded to parameter with the worse evidence of malnutrition. The CANSCORE ranges between 9 (lowest) and 36 (highest). Babies with CANSCORE below 25 is regarded as having FM. The score consists of nine ‘superficial' readily detectable signs of fetal malnutrition. This was based on inspection and hands–on estimates of loss of subcutaneous tissue and muscles. Hairs, Cheeks, Neck and Chin, Arms, Back, Buttock, Legs, Chest and abdomen were examined thus and then scored. This is a purely clinical assessment like Ballard or Dubowitz assessment of gestational age scores. It is very easy to carry out by the bedside. It identifies babies with FM whether small, appropriate or large for gestational age (SGA, AGA or LGA). Using this method we have found that about 11.5 percent of AGA babies have FM. Most babies are AGA.[25]A proportion of 11.5 percent of AGA is a too large number of babies to be ignored. We therefore propose that CANSCORE should be routinely done at birth to minimize the sequelae of FM by prompt and appropriate treatment the identified babies.

CONCLUSION

Fetal malnutrition is a clinical state with easily identifiable clinical features. Just as scabies is scabies with definite features irrespective of population in which it is being described. Features of FM are independent of weight and specific enough. Proportion of babies with FM may therefore be a better index than LBW rate, SGA, IUGR and other anthropometric measurements for international comparison of fetal well-beings in different populations. This is what we are proposing.

CORRESPONDENCE TO

Professor J. A. Owa Department of Paediatrics and Child Health, Obafemi Awolowo University, Ile-Ife, 220005, Nigeria E-mail: jowa@oauife.edu.ng or jaowa2001@yahoo.co.uk

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Author Information

Owa Joshua Aderinsola
Professor, Department of Paediatrics and Child Health, Obafemi Awolowo University

Adebami Olusegun Joseph
Lecturer, Department of Paediatrics and Child Health, Ladoke Akintola University of Technology Teaching Hospital