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reliable in the post-natal estimation of gestational age amongst caucasian North American neonates. To our knowledge, no such study has been carried out on black newborn infants. This study was therefore undertaken to determine the relationship between the thoracic spine length and gestational age of Nigerian newborn babies. A second objective was to compare the pattern of intrauterine growth of these infants with that of their caucasian counterpart using the thoracic spine length as an index. Lastly, it was of interest to evaluate the effect of intrauterine malnutrition on the development of the spine of SGA infants.

Materials and methods

Thoracic spine length was measured on chest radiographs of forty-nine newborn infants who were admitted to the Special Care Baby Unit of the University of Benin Teaching Hospital using the method described by Kuhns and Holt (1975) (Fig. 1). All radiographs were exposed within 48 h of life. Cases with rotation, positional scoliosis or congenital spinal anomalies were excluded. A focal film distance of 100 cm, average exposure factors of 40 KVP and 2 mAs, and fast films were used. No correction was made for magnification. The majority of these infants were admitted for respiratory distress of various causes such as pneumonia, asphyxia secondary to meconium aspiration and respiratory distress syndrome. Gestational age estimation was based on obstetric history, physical characteristics (Usher & McLean, 1969) and neurological evaluation (Dubowitz, Dubowitz & Goldberg, 1970). If the gestational age as estimated from physical and neurological characteristics differed from that calculated from the maternal history, then gestational age was derived from physical and neurological findings alone. A total of thirty-eight of these forty-nine infants were between the tenth and ninetieth percentile of the mean weight for the gestational age using the intrauterine growth curve of Lubchenco, Hansman and Boyd (1963). Linear regression analysis was applied to the relationship between the thoracic spine length and gestational age for these thirty-eight infants.

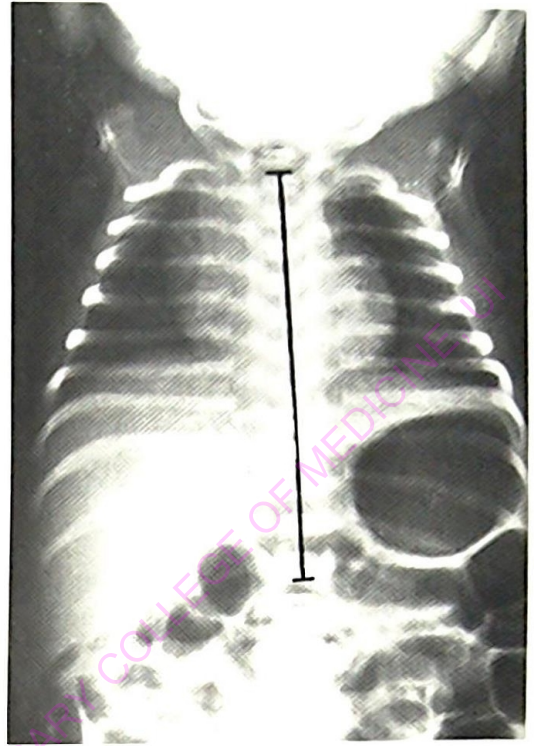


FIG. 1. The thoracic spine length was measured from the superior border of the first thoracic vertebra to the inferior border of the twelfth vertebra as shown on this chest radiograph.

Results

Figure 2 shows the relationship between the thoracic spine length and gestational age from 29 to 41 weeks. The thoracic spine lengths of all the SGA infants were below 2 s.d. of the mean for the AGA infants. Amongst the latter group, the correlation coefficient was 0.93. There was no difference in spine length values between the sexes.

Discussion

This study shows that the thoracic spine length increases linearly with gestational age between 29 and 41 weeks of gestation in Nigerian newborn babies. This is in agreement with the findings of Kuhns and Holt (1975). A comparison of our findings with those of the same authors shows that our babies have retarded spine lengths throughout pregnancy (Fig. 3). This pattern of intrauterine growth in African

ESTIMATION OF GESTATIONAL AGE OF NIGERIAN NEWBORN INFANTS BY MEASUREMENT OF THORACIC SPINE LENGTH ON CHEST RADIOGRAPHS

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Summary

Thoracic spine length was measured on chest radiographs of forty-nine Nigerian neonates of known gestational age. There is a strong correlation between gestational age and thoracic spine length ($r = 0.93$). The small-for-gestational-age (SGA) infants had thoracic spine lengths below two standard deviations (s.d.) of the mean for the appropriate-for-gestational-age infants. This method is useful for identifying SGA infants on chest radiographs particularly when they are too ill to be subjected to the usual physical and neurological assessment of gestational age.

Résumé

En mesurant la longueur de la colonne vertébrale thoracique sur des radios de la poitrine de quarante-neuf nouveaux-nés Nigériens d'âge de gestation connu, on a trouvé une relation marquée entre l'âge de gestation et la longueur de la colonne vertébrale thoracique ($r = 0.93$). Les enfants petits pour leur âge de gestation ont des longueurs de colonne vertébrale thoracique dont l'écart-type est moins de deux comparé à la moyenne pour les enfants normaux pour leur âge de gestation. Cette méthode permet d'identifier les enfants petits pour leur âge de gestation sur des

radios de la poitrine, en particulier quand ils sont trop malades pour être soumis à l'évaluation habituelle physique et neurologique de l'âge de gestation.

Introduction

Post-natal gestational age estimation has assumed increased importance since the introduction of the concept of small-for-gestational-age (SGA) infants. It is important to identify these high-risk infants because they are more prone to diseases which are hardly encountered in the appropriate-for-gestational-age (AGA) infants (Battaglia & Lubchenco, 1967). The traditional radiological method for assessing gestational age is the evaluation of the pattern of appearance of ossification centres in the knees (Christie, 1949; Schreiber *et al.*, 1962). Opinions differ as to the degree of reliability of this method. Russell (1968) claimed that pre-natal radiological examination gave a better prediction of gestational age than figures calculated from maternal history. Hartley (1957) concluded from his study that the prediction of the time of delivery was possible to within a few days on the basis of pre-natal radiological examination. Schreiber *et al.* (1962) however, showed that visualization of the proximal femoral epiphysis was considerably less reliable in assessing gestational age than previously thought.

Recently Kuhns and Holt (1975) have found measurement of thoracic spine length on chest radiographs to be accurate and

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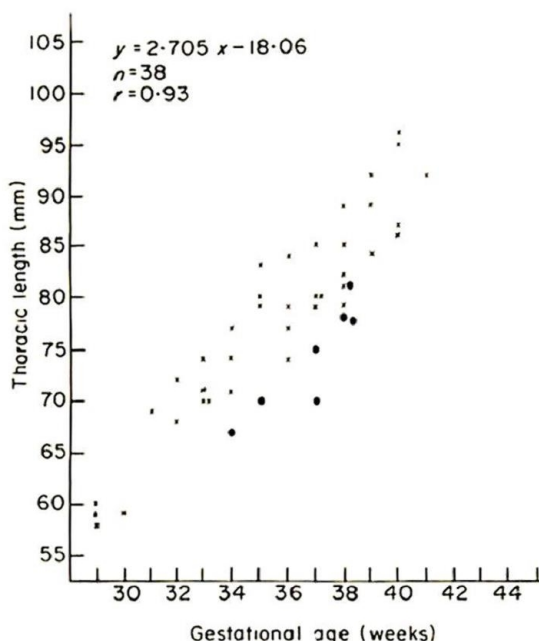


FIG. 2. Scattergram of thoracic spine length and gestational age for AGA and SGA babies. x, AGA; •, SGA.

babies confirms the findings of Singer, Blake and Wolfsdorf (1973). Those authors showed that Rhodesian black newborn infants had lower maturity scores than their British counterparts who were studied by Dubowitz *et al.* (1970).

Our results would indicate that the SGA infants have delayed skeletal maturation as measured by the thoracic spine. This may be consequent to prolonged and severe malnutrition which began early in foetal life (Usher, 1970). It is therefore of practical significance that this group of high risk infants who very often may require chest radiographs, can be easily identified by measuring the thoracic spine.

It is suggested that thoracic spine length should be used by the radiologist, in conjunction with other parameters such as subcutaneous fat thickness (Kuhns *et al.*, 1974), humeral head and coracoid ossification (Kuhns *et al.*, 1973) and tooth mineralization (Kuhns *et al.*, 1972). In most developing countries where mothers are often unable to give accurate dates of their last menstrual periods and in situations where newborn infants are too sick to be adequately assessed

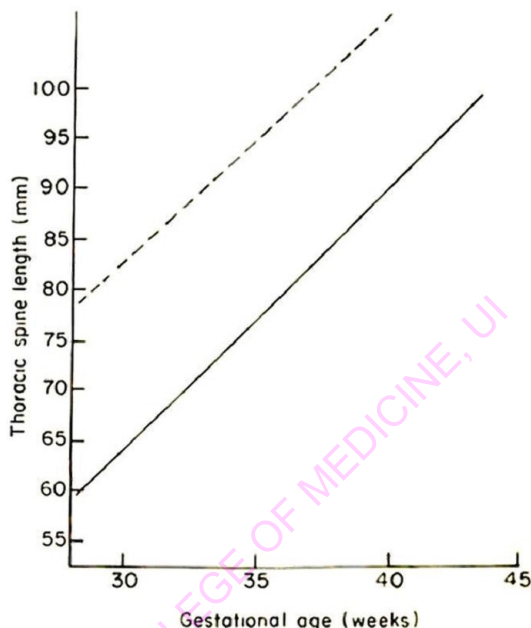


FIG. 3. Comparison of thoracic spine lengths between Nigerian and Caucasian newborn infants. - - -, Kuhns and Holt (1975); —, present study.

clinically and neurologically, radiologic evaluation of gestational age might be useful.

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