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Ultrasound measurement of foetal head to abdomen circumference ratio in pregnant Nigerians

B. O. OSINUSI
Department of Obstetrics and Gynaecology, University College Hospital, Ibadan, Nigeria

Summary

The ratio of foetal head to abdomen circumference ratio has been established in 242 foetuses scanned between 16 weeks and 40 weeks of gestation. The ratio was observed to fall gradually from 1.30 at 16 weeks to 1 at 30–32 weeks, and more slowly thereafter to 0.95 at term. The value of this ratio in differentiating between symmetrical and asymmetrical growth-retarded foetuses and in the management of such pregnancies is discussed.

Résumé

Le rapport de la tête foetale à la circonférence de l'abdomen foetal a été déterminé dans 242 foetus explorés à entre 16 et 40 semaines de gestation. D'après notre observation le rapport a chuté graduellement de 1.30 à 16 semaines à 1 à 32–34 semaines, et par la suite encore plus lentement jusqu' à attendre 0.95 au terme de la période de gestation. Nous discutons également la valeur de ce rapport pour différencier entre les foetus à croissance rétardée symétrique et asymétrique et dans la gestion des telles grossesses.

Introduction

In an effort to reduce perinatal mortality there has been a continuous search for methods of identifying the foetus at risk.

Intrauterine growth retardation has been shown to be associated with an increased risk of ante-partum death. Usher and McLean [1], in a series of 44,256 consecutive births between 1958 and 1971, reported that perinatal mortality is ten times higher in babies born more than two standard deviations under weight compared with those whose birth weights were within two standard deviations of the mean.

Campbell [2], in a serial cephalometric study, identified two types of intrauterine growth retardation, the symmetrical and asymmetrical types. The first is where there is a symmetrical reduction of all organ sizes and the second is when the head is preferentially spared in the growth-retarding mechanism. It is now known that these two types have different aetiological factors and also different perinatal and long-term risks. Therefore, it would be of great value to distinguish between them antenatally to afford the clinician a more logical and rational approach to the management.

Campbell and Thoms [3] described the foetal head to abdomen ratio as a useful means of making this distinction. It is the aim of this paper to describe such a ratio amongst a population of pregnant Nigerians.

Subjects and methods

The subjects (242) were recruited from the Antenatal Clinic of the University College Hospital, Ibadan. They were recruited on confirmation that: (i) they were sure of their last menstrual periods, (ii) the uterine size on recruitment was compatible with the period of amenorrhoea, and (iii) the pregnancy was singleton and uncomplicated.

All the subjects were scanned between 16 weeks and 40 weeks of gestation by the author, using a Philips SDR 1000 real-time ultrasound machine equipped with a 2.5 MHz linear array transducer and an omnidirectional electronic caliper system calibrated at a sound speed of 1540 m/s.

Most of the subjects were scanned once but a few were scanned two or three times to obtain a total of 285 measurements.

The appropriate section for the head circumference (HC) measure was a horizontal section through the head that included both the biparietal (BPD) and the occipito-frontal (OFD) diameters, as described by Campbell and Thoms [3].

Having obtained this section the HC was computed by the formula of Chervenak *et al.* [4]:

$$HC = (BPD + OFD) \times 1.62.$$

For each foetus the averages of two sets of BPD and OFD measurements were used in computing the head circumference.

The abdominal circumference (AC) was obtained by taking a transverse section through the upper abdomen of the foetus, showing the umbilical vein as it passes under the liver [5]. Two sets each of transverse and antero-posterior diameters were obtained from each foetus, and the means of the readings were then used in computing the abdominal circumference, using the formula described by Chervenak *et al.* [4]:

$$AC = (\text{transverse diameter} + \text{antero-posterior diameter}) \times 1.57.$$

The head circumference to abdomen circumference ratio was calculated for each gestational age.

Results

Table 1 shows the head to abdomen ratio between 16 weeks and 40 weeks of gestation, as calculated from the mean values of the head and abdomen circumferences. The ratio shows a gradual decline from 1.30 at 16 weeks to 1.00 at 30–32 weeks, and thereafter declining gradually to 0.95 at term. Figure 1 represents the data graphically.

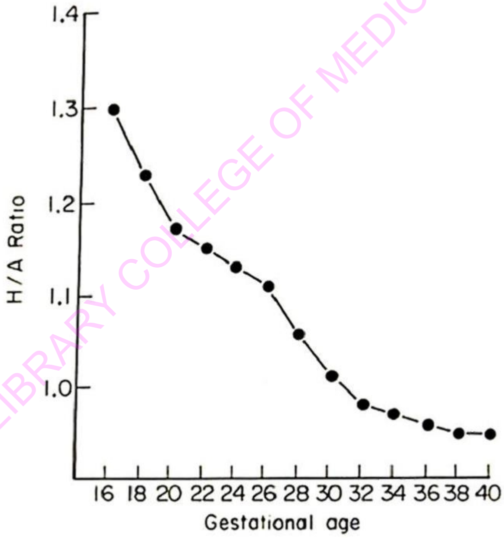

Fig. 1. Head to abdomen circumference ratio.

Table 1. Head to abdomen circumference ratio at various gestational ages

Gestational age (weeks)	Head circumference (cm)	Abdominal circumference (cm)	Head:abdominal circumference ratio
16	12.12	9.3	1.30
18	14.6	11.86	1.23
20	16.32	13.83	1.18
22	18.7	16.3	1.15
24	20.8	18.24	1.14
26	22.9	20.6	1.11
28	25.4	23.96	1.06
30	26.5	26.25	1.01
32	28.5	29.0	0.98
34	30.5	31.2	0.97
36	32.1	33.3	0.96
38	33.2	34.9	0.95
40	34.04	35.8	0.95

Discussion

Our data have shown a gradual decline in the head to abdomen ratio from 16 weeks to term. This is similar to the findings of previous studies [3,6].

In this study, the head to abdomen ratio fell to 1 between 30 weeks and 32 weeks of gestation, which contrasts with the study by Campbell and Thoms [3], where it fell to 1 at 36 weeks. However, the rate of decline is so small that the smaller number of subjects in our study could have accounted for this.

Crane and Kopta [6] challenged the premise on which the head to abdomen ratio is based by showing from anthropometric measurements of newborn infants that brain sparing is variable in the growth-retarded foetus. This cannot be surprising as there are bound to be biological variations even in an abnormal sample.

Nevertheless, these data would be useful in an environment like ours in which placental insufficiency is as common as chronic malnutrition as a cause of intrauterine growth retardation. Although many other parameters, both clinical and biochemical, have been found reliable in the management of intrauterine growth retardation, the ultrasound head to abdomen ratio, along with other ultrasound parameters, would definitely prove useful in our antenatal management of this condition in order to reduce perinatal mortality.

It is hoped that the value of these data would be tested in a study of growth-retarded foetuses in our environment in the near future.

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