Biparietal Diameter, Fetal Maturity, and Body Weight in Rural Tanzanian Newborns

by J-H. Gutknecht, MD, DTM&H (Liverpool)
Mbesa Mission Hospital, Tanzania

Summary

The biparietal diameter (BPD) in 202 rural Tanzanian newborns was measured and correlated to maturity and body weight. The mean BPD at birth was 9.0 cm. The average body weight was 2642 g. Fetal maturity was determined by Petrussa score, serving as an estimate for gestational age. The mean gestational age of the 202 newborns was 39 weeks. The average body weight of the mature babies (gestational age 38–40 weeks) was 2765 g. All babies less than 38 weeks of gestation were born with a low birth weight (LBW ≤ 2500 g) except for one. The LBW-babies comprised 34 per cent of the total births. About two-thirds of all LBW-babies (62 per cent) were born small for date, only 38 per cent preterm. Regression analysis of the data set was performed resulting in significant models of estimates of gestational age and body weight from BPD as well as body weight from gestational age. In a baby older than 35 weeks of gestation a body weight of more than 1500 g can be expected. With regard to maturity (≥ 36 weeks) and body weight (≥ 1500 g) there is a good chance of survival when the BPD exceeds 7.5 cm. The analysis of our data denotes that tables from industrialized countries relating gestational age to sonographically measured BPD are not applicable for pregnancies in developing countries.

Introduction

Mbesa Mission Hospital is situated in the remote Tunduru District, Ruvuma Region, Tanzania, close to the border with Mozambique. The population in the hilly bushland (altitude 500 m) lives in scattered villages connected only by mud roads. Poor transport facilities often cause difficult accessibility of the hospital, particularly in the rainy season. Referral to other hospitals is impossible. The hospital has 130 beds, at least 12 of these for obstetric patients. In the Outpatients Department about 23,000 new and 20,000 reattending patients are seen yearly, and 3700 patients are admitted. Seven-hundred women come to the hospital for delivery every year. Close co-operation exists between the Mother and Child Health clinic and the doctor’s office for consultation about mothers with risk factors. The hospital has 80 employees. Many patients visiting the hospital are illiterate and not acquainted with the use of a numerical calendar. Most of them cannot report the date of their last menstrual period (LMP). To estimate the duration of pregnancy and the maturity of the baby the following methods can be applied:

1. Asking the pregnant woman for how long according to her opinion she has been pregnant. She may know the duration of her pregnancy in months. This duration is calculated by some mothers either from the month of her LMP or from the first month without menstrual period. The latter method is followed by the Yao tribe in the Mbesa region in southern Tanzania. The answer may leave us with an inaccuracy of the duration of pregnancy of 1 month.

2. Examining the fundal height may result in a more objective measure of the duration of pregnancy. African mothers, however, tend to be shorter than women in industrialized countries, yet their babies are usually not much smaller. Therefore, there are different schemes to estimate the gestational age by measuring the fundal height according to anatomic signs. In the African/Tanzanian situation fundal height reaches the position used in industrialized countries for the estimation of duration of pregnancy about 4 weeks in advance.1 Therefore, measuring the fundal height only will leave us again with a possible inaccuracy of 1 month.

3. Ultrasound measurement of BPD provides a reliable method of the estimation of the duration of pregnancy. However, since the very accurate tables of the duration of pregnancy related to BPD originate from industrialized countries of the northern hemisphere2 they cannot be applied in developing countries. The majority of mature babies are born with lower body weights (and accordingly smaller heads). This would mean that they would be considered to be mature with a smaller BPD than the babies of the northern hemisphere. We have examined the correlation of BPD with maturity and with body weight at birth in the Tanzanian situation.

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Correspondence: P.O. Box 1354, D-91709 Gunzenhausen, Germany.
Materials and Methods

Over a period of 11 months (1988/89) 202 babies were measured after birth: body weight, height, and head circumference as per routine, maturity was estimated according to the Petrussa score (Table I) by which a fairly reliable impression of the maturity of the newborn can be obtained.

One to three days after birth the BPD was checked with pelvic measurements. We determined the widest portion of the head from one parietal bone to the other in steps of 0.25 cm. It was not suitable to measure the BPD directly after delivery since the BPD increases rapidly within the first day (0.25–0.50 cm), but changes only slowly afterwards. This difference of the post-partal BPD within the first days may be explained by compression of the head during the birth process, which is restored after one day. The BPDs measured after the first day of life corresponded to the values determined before birth by ultrasound.

For ultrasound examinations an ADR Kranzbühler Model 2130 with transducer of 3.5 MHZ was used. The sonographically determined BPD is the measurement at a 90° angle to the median echo over the widest portion of head from external to external contour.

Descriptive statistics and regression analysis have been carried out with the statistical package MINITAB on an IBM-IT compatible microcomputer.

All babies were African. Most mothers belonged to the Yao tribe and lived in the Tunduru District near the southern Tanzanian border to Mozambique.

Results

Our first interest was to know the average BPD of the mature newborns, being 9.1 cm (SD = 0.48 cm). Figure 1 shows an almost normal distribution for BPD of all 202 babies with a maximum around 9.0 cm. In 87 per cent, the BPD of the babies lay between 8.25 and 9.75 cm.

Regarding the correlation of the babies' maturity with their BPD. Figure 2 shows a gestational age of 37 weeks at a BPD of 7.6 cm and maturity (38 weeks) with a BPD of 8.25 cm. Full maturity (gestational age of 39 and 40 weeks) is reached with a BPD of 9.0 cm.

Figure 3 shows that from BPD 7.5 cm a correlation with a birth weight of 1500 g can be expected.
What was the average body weight of the mature babies? From 38 weeks of pregnancy a mature baby can be expected. The mean of these babies’ weights was 2765 g (SD = 482 g). Twenty-six babies (13 per cent) were born with a maturity of 37 weeks or less (Fig. 4). The mean weight of those immature babies was 1839 g (SD = 499 g). The body weight of the 202 newborns followed a normal distribution (Fig. 5) with a maximum of 2501–3000 g (mean 2642 g, SD = 577 g). Sixty-nine babies (34.2 per cent) were born with a low birth weight (LBW, less than 2500 g).

Figure 6 shows that the majority of the LBW babies were born mature, indicating that the babies in our study were mostly small for date and not premature (preterm). Only 12 babies (6 per cent) were born with a gestational age of 36 weeks and less. Although this is a small number we may expect a sufficient body weight (2000 g) from the 36th week of gestation. All babies (except for one) born before 38 weeks of gestation were born with LBW. These 26 (13 per cent) babies were premature with LBW. From the mature babies (gestational age 38–40 weeks) 44 (22 per cent) were born with LBW, indicating the number of babies small for date.

Discussion

1. As presumed this study shows that the babies in our region reach maturity with smaller biparietal diameters and lower body weight than babies of the northern hemisphere.

Most of our mature babies reached a BPD of 9.0 cm at birth, correlating with an estimated gestational age of 39 weeks according to the regression equation (Fig. 2). A BPD of 9.0 cm corresponds with only 35.4 weeks of gestation in tables of Germany. Because of this difference they do not apply to our situation. In an Aboriginal population in Amhem Land, Australia, Watson demonstrated the same effect comparing his data with a US standard.

2. As demonstrated LBW babies comprised 34 per cent of our total births. This figure is much higher than figures of industrialized countries (Germany 6 per cent, 1990) and even from Tanzania and Africa (Tanzania 14 per cent, Africa 11–21 per cent, world 17 per cent, 1990). The high prevalence (21 per cent) mature, but small for date is a result of poor socio-economic conditions in our region.

The proportion of preterm babies observed (13 per cent) is comparable to findings in other developing countries. Watson had found 14 per cent. Preterm babies make up a smaller proportion of all LBW babies in developing countries because of a high prevalence of small for date babies (62 per cent in our study).

3. We expect a good chance of survival from more than 36 weeks of gestation. In our study the corresponding BPDs to gestational ages higher than 36 weeks were more than 7.5 cm (Fig. 2). The corresponding body weights to BPDs of more than 7.5 cm were well above 1500 g (Fig. 3). A BPD of 7.75 cm correlated with a body weight of 1849 g (Fig. 3). With regard to maturity and body weight we expect a good chance of survival above a BPD of 7.5 cm. This value shows again that the tables of industrialized countries giving gestational age from sonographically determined BPD are not applicable for pregnancies in developing countries (at least not for the last trimester). Whereas, in our study, a BPD of 7.5 cm correlated with a gestational age of 36.8 weeks (Fig. 2) it corresponds to 28.6 weeks on German tables.

4. A coefficient of 0.698 (Fig. 3) for the correlation of BPD and body weight is consistent with observations in...
Indian infants. Raman et al. published a correlation coefficient of 0.68 for the association between head circumference and birth weight.

Linear regression analysis to estimate birth weights from sonographically determined anthropometrical parameters is recommended by Morgenstern et al.\textsuperscript{5} Concerning the BPD their publication denotes the following equation: weight = \(-3900 + 750\text{ BPD}\) as a result of meta analysis of numerous studies. For an arbitrarily chosen BPD of 9.0 cm an estimated birth weight of 2850 g could be calculated. According to our equation (Fig. 3) a birth weight of 2658 g would be the outcome (\(P = 0.001, t\)-test), also indicating that the babies in our study tend to have lower birth weights for given BPDs compared to babies of industrialized countries.

References