Symphysis Fundus Height Measurements during Labour: A Prospective, Descriptive Study

BK Bothner¹, AM Gulmezoglu¹ and GJ Holfmeyr¹

ABSTRACT

This study was conducted to determine the correlation between symphysis fundus height (SFH) measurements and infant weight. It was also to examine whether descent of the fetus or rupture of the membranes affects the relationship and to calculate a simple formula for estimation of fetal weight. A descriptive prospective study design was used. The setting was the teaching hospitals in Johannesburg. Results show that there is a good correlation between SF measurements and birthweight \( (r = 0.56) \) and also between the product of SF measurements and abdominal girth \( (r = 0.57) \). The correlation of abdominal girth alone and birthweight was less significant \( (r = 0.47) \). Rupture of the membranes has minimal effect on the measurements. The correlation of SF measurements with birthweight was highest when subtracting engagement of the head (in fifths above the pelvic brim) from the SF measurement \( (r = 0.64) \). In conclusion, fundal height among women with similar size fetuses varies widely. The formula created from the observations was not sufficiently accurate to be clinically useful. The primary value of SF measurements is to assess fetal growth over time by repeated measurements in individual pregnancies. (Afr J Reprod Health; 4[1]:48-55)

RÉSUMÉ

Les mesures de la hauteur du fond de la symphyse pendant l'accouchement: étude perspective descriptive. Cette étude avait pour but de déterminer la corrélation entre les mesures de la hauteur du fond de la symphyse (HFS) et le poids infantile. L'étude se donnait aussi la tâche d'établir si la descente du foetus ou la rupture de membranes a un effet sur les rapports et de calculer une simple formule pour l'estimation du poids de foetus. Une organisation de l'étude perspective descriptive a été utilisée dans ce travail encadré dans des Centres Hospitaliers Universitaires à Johannesburg. Les résultats démontrent qu'il existe une bonne corrélation entre les mesures FS et le poids de naissance \( (r = 0.56) \) et aussi entre le produit de mesures FS et le volume de l'abdomen \( (r = 0.57) \). La corrélation du volume de l'abdomen seulement et le poids de naissance était moins significative \( (r = 0.47) \). La rupture de membranes n'a que d'effets minimaux sur les mesures. La corrélation des mesures FS avec le poids de naissance était plus élevée au moment de soustraire l'engagement de la tête (en cinquièmes au-dessus du bord pelvien) de la mesure FS \( (r = 0.64) \). En conclusion, la hauteur fundique varie beaucoup parmi les femmes qui ont les foetuses de même taille. La valeur primaire de mesures FS est d'évaluer la croissance foetale au cours d'une période à travers des mesures répétées de grossesses individuelles. (Rev Afr Santé Reprod 2000; 4 [1]:48-55).

KEY WORDS: Symphysis fundus height, labour, fetal growth

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Introduction

Identification of the at-risk fetus represents one of the main problems in modern obstetrics, in spite of a wide range of clinical, biochemical and ultrasonographic techniques available. Ultrasonographic measurement including biparietal diameter, head circumference, abdominal circumference and femur length, are reasonably sensitive for diagnosing impaired fetal growth, detecting about 85% of low birthweight babies, but it is not readily available as a screening method in many hospitals, particularly in developing countries.

Clinical estimation of fetal weight by external palpation has been found to give errors exceeding 800g in about 50% of cases, and in term pregnancies to be as inaccurate as guesswork. Measurements of symphysis fundal height (SFH) with a tape along the anterior abdominal curvature have met with varying degrees of success in estimating fetal size. Some authors found graphic presentation of symphysis fundal height measurements to monitor fetal growth during pregnancy very accurate and useful, whereas other authors found this method not sensitive and specific enough. The predictive effect is said to be maximum at around 32 weeks of pregnancy. Measurements of maternal abdominal circumference have also been used by several authors, but these measurements are influenced by biological variations such as skin fold thickness and maternal weight. Walraven et al compared the value of different maternal anthropometric indices for predicting birthweight and found symphysis fundal height a better predictor than maternal height, pre-delivery weight or mid-upper arm circumference.

Intrapartum birthweight estimation is often needed to give an indication of viability, the need for referral to a centre with neonatal facilities, the method of delivery for breech presentations or the risk of shoulder dystocia. The purpose of this study was to evaluate the extent to which variables that change during the course of labour influence symphysis fundal height measurements and whether it is possible to devise a correction factor for estimation of birthweight, taking these changes into account.

Materials and Methods

A descriptive prospective study was designed. After approval by the Committee for Research on Human Subjects of the University of the Witwatersrand, 248 patients admitted to Coronation, JG Strijdom and Baragwanath Hospitals for labour and delivery were recruited. Patient selection criteria were age >18 years, singleton pregnancy, live fetus, longitudinal lie, no major congenital abnormality, established labour and no immediate indication for caesarean section. During routine admission, baseline data were recorded for age, parity, gravidity, period of amenorrhoea, gestational age by sonar (if done antenatally), weight, height and possible antenatal complications. Women who fulfilled the criteria were then asked to participate in the study. After verbal consent was obtained, the following findings were recorded: time of admission examination; symphysis fundus height (SFH) measurement; abdominal girth; engagement of the head; cervical dilatation and effacement; station of the head (in fifths above the pelvic brim); membranes intact or ruptured and a subjective assessment of the women's general appearance made (thin – average – obese).

Uterine height measurements were taken with a metric tape made of non-elastic material. The measurements were taken from the upper border of the symphysis pubis to the highest point of the uterine fundus lying in contact with the abdominal wall. The fundus was defined by gentle pressure exerted in a plane at right angles to the abdominal wall. Measurements were recorded to the nearest 0.5cm. No correction for the status of the bladder was made. The measurements of abdominal girth were also taken with a non-elastic metric tape at the level of the umbilicus at the end of a normal expiration. The patients were re-examined approximately every two hours until delivery, for change in SFH measurements, engagement of the head, cervical dilatation and status of the membranes. After delivery, records were made of mode of delivery, birthweight of the baby, sex, Apgar scores, head circumference and length.

Linear regression analysis was performed between symphysis fundus height measurements and birthweight, taking into account factors that might influence these measurements. Spearman's rank correlation was used as a measure of correlation between SFH and birthweight, the product of SFH and abdominal circumference and birthweight, and abdominal circumference and birthweight.
Graphics Corporation 1993) was used for the analysis.

**Results**

Baseline data were obtained from 248 patients, 191 patients had a re-examination after a mean of 158 mins and in 50 patients another reassessment was possible (mean 160 mins later). Most of the patients delivered before a second reassessment was due.

Table 1 shows the clinical characteristics of the women. The median weight was 63 kg. Abdominal girth was within normal range with a median of 96 cm. The birthweight ranged from 800 to 4415 g with an average weight of 2900 g and a median of 3075 g (Table 2). The data for symphysis fundus height, cervical dilatation and engagement at each consecutive examination are given in Table 3.

### Table 1 Maternal Baseline Characteristics

<table>
<thead>
<tr>
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<th>Median</th>
<th>Range</th>
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<tbody>
<tr>
<td>Age (yr)</td>
<td>24</td>
<td>19–42</td>
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<tr>
<td>Parity</td>
<td>1</td>
<td>0–6</td>
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<tr>
<td>Gestational age (dates)</td>
<td>39</td>
<td>27–44</td>
</tr>
<tr>
<td>Gestational age (sonar)</td>
<td>39</td>
<td>25–42</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>63</td>
<td>45–99</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>157</td>
<td>145–176</td>
</tr>
<tr>
<td>Abdominal birth (cm)</td>
<td>96</td>
<td>78–123</td>
</tr>
</tbody>
</table>

### Table 2 Neonatal Outcome Variables

<table>
<thead>
<tr>
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<th>Median</th>
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<tbody>
<tr>
<td>Birthweight (g)</td>
<td>3075</td>
<td>800–4415</td>
</tr>
<tr>
<td>Apgar (1 min.)</td>
<td>8</td>
<td>0–10</td>
</tr>
<tr>
<td>Apgar (5 min.)</td>
<td>9</td>
<td>0–10</td>
</tr>
<tr>
<td>Head circumference (cm)</td>
<td>34</td>
<td>24–48</td>
</tr>
<tr>
<td>Length (cm)</td>
<td>50</td>
<td>31–61</td>
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</table>

### Table 3 Assessments

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1st Assessment (158 min)</th>
<th>2nd Assessment (160 min)</th>
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</thead>
<tbody>
<tr>
<td>n</td>
<td>248</td>
<td>191</td>
<td>50</td>
</tr>
<tr>
<td>SFH</td>
<td>33 (23–44)</td>
<td>32 (23–43)</td>
<td>32 (26–43)</td>
</tr>
<tr>
<td>Cervix (cm)</td>
<td>5.2 (0–10)</td>
<td>7.3 (2–10)</td>
<td>7.4 (4–10)</td>
</tr>
<tr>
<td>Engagement</td>
<td>2.9 (0–5)</td>
<td>2.2 (0–5)</td>
<td>2.2 (1–4)</td>
</tr>
</tbody>
</table>
Figure 1  Correlation between Symphysis Fundus Height and Birth Weight

Figure 2  Sysphysis Fundus Height — Fifths Measurements and Correlation to Birth Weight
Correlation between symphysis fundus height measurements and birthweight was highly significant ($r = 0.56$ and $p = 0.000$ [Figure 1]). The product of SFH and abdominal girth correlated well with birthweight as well ($r = 0.57$, $p = 0.000$). Abdominal girth alone and birthweight correlated less well ($r = 0.47$, $p=0.000$). Values obtained by subtracting engagement of the head in fifths from the SFH measurement showed a higher correlation with birth weight than SFH alone ($r = 0.64$, $p = 0.0000$ [Figure 2]). From the linear regression equation, a formula was created to estimate the birth weight from the measurements obtained by subtracting 20 as the y-intercept and engagement in fifths, then multiplying the value by the factor 300 for $1/\text{slope}$ (estimated birth weight = (SFH – fifths – 20×300). Figure 3 is a graph of residuals showing the deviation of the estimated from the actual birth weight.

**Discussion**

Prematurity and low birthweight are major causes of perinatal morbidity and mortality in developing countries, the incidence being around $40\%$, $5,7,26$ compared with around $6\%$ in developed countries. Antenatal estimation of birthweight is known to be difficult and inaccurate. On the other hand, birthweight correlates well with perinatal outcome.$^{26}$ Ultrasonographic weight estimation to detect the fetus at risk is usually not available in peripheral hospitals and midwives' units. Even if ultrasound is available, measurements are likely to be more inaccurate during labour, especially if the membranes are ruptured and the presenting part is engaged into the pelvis, because these factors make ultrasound visualisation difficult.

Clinical estimation of fundal height is practised widely to predict birthweight, although proven un-
Reliable. Symphysis fundus height measurement with a tape seems a simple clinical method, because it is cheap, readily available, non-invasive and acceptable to patients. Growth charts have been developed for different population groups, considering the influence of race, weight and height on symphysis to fundal height and used successfully during the antenatal period to detect fetal growth abnormalities by different authors, although some questioned their usefulness. Others found them accurate only if the period of amenorrhoea was known, or when measurements were combined with an ultrasound examination. Intrauterine death in small for gestational age babies occurs mainly in the last two to three weeks of pregnancy. Maternal risk anamnesis and early detection of pregnancy complications are important aspects in decision-making and should be used in combination with a standard growth chart. There are only a few studies which consider the patient presenting in labour. Very often one is confronted with a patient in whom delivery of a premature baby might be imminent. The decision to transfer a patient to a secondary or tertiary care centre and the mode of delivery are to a large extent determined by estimated fetal weight. We tried to assess whether SFH measurement on a patient in labour would predict birth weight more accurately by including variables such as the woman's appearance, status of the membranes, engagement of the head, etc. The results of our study do not confirm the findings of Hoelscher et al that a SFH measurement of 29cm reasonably predicts babies with a birthweight less than 2.0kg.

The results show wide variation in fundal height between women with similar size fetuses, which was influenced by the general physical appearance of the patient. As in Belizan's study, there was no variation in the distribution of SFH measurements due to the status of the membranes, but unlike Belizan and India, engagement of the head was found to be an important factor. These findings agree with the studies of Lindhard and Westin. Engstrom examined the effect of bladder volume on fundal height measurements. According to this study, the previod fundal height measurements were significantly higher than the postvoid fundal height measurements, but the differences were significantly smaller in women who had voided within 30mins before measurements were obtained. We neither recorded bladder volume nor did we correct the measurements for it, but certainly this point should be taken into account as it seems to influence measurements as much as does engagement of the head. As have others, we found a good correlation between SFH measurement and birthweight. The correlation between the product of SFH and abdominal girth was slightly better, whereas abdominal girth measurements alone showed poorer correlation with birth weight. These findings have been described before. Abdominal girth is more influenced by maternal weight and skinfold-thickness than is fundal height measurement.

We found that engagement of the fetal head was associated with a reduction in symphysis fundus measurements on average of about 1cm per fifth of head above the bami from 4 fifth to 1 fifth. Measurements in obese women exceeded those in thin women by about 4 to 5cm, relative to fetal weight. Unfortunately, our attempts to combine additional factors such as engagement of the head with the symphysis fundus measurements did not reduce the error in weight estimation to a level which would be clinically useful. The main value of symphysis fundus measurements is likely to remain its serial use to monitor fetal growth in individual pregnancies rather than absolute weight estimation. For growth monitoring, factors such as maternal obesity and anatomical differences remain relatively constant. It is important to keep in mind the importance of always doing the measurement with an empty bladder. Our findings suggest that towards term, engagement of the fetal head may account for a decrease in SF measurements of about 1cm per fifth of head. Correction of serial SF measurements for changes in engagement of the head from one measurement to the next may reduce the chance of falsely diagnosing poor growth. The practical usefulness of this principle will need to be evaluated in a longitudinal study.

Acknowledgements

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REFERENCES


