PARTURIENT FUNDAL HEIGHT AND BIRTH WEIGHT ESTIMATION

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Background- Considering the hazards of macrosomia and low birth weight, the estimation of birth weight before delivery is of paramount importance. An easy-to-do method of birth weight estimation is fundal height measurement using only a tape measure. In the present study, we determined the association between fundal height and actual birth weight and calculated the specificity, sensitivity and positive and negative predictive values for the method.

Methods- Standard fundal height was measured on 450 pregnant women who were hospitalized in Imam Khomeini and Shariati Hospitals in Tehran, Iran, for delivery during a 6-month period in 2000. All measurements were performed within the 5 last days of pregnancy. Inclusion criteria were normal pregnancy, cephalic presentation of the fetus and maternal weight of less than 91 kg. The parturient patients with systemic disease, history of stillbirth, poly or oligohydramnios, placental abnormality, twin or multiple pregnancies and fetal congenital anomaly were excluded from the study. Linear regression analysis was used to determine the association of fundal height to actual birth weight.

Results- A prospective linear regression was found between fundal height and actual birth weight ($r = 0.88$, $p < 0.01$) correct estimation of birth weight was obtained in 349 (77.5%) of cases. The specificity of estimated weight was 91.5% when the real birth weight was within the normal range.

Conclusion- For actual birth weights in the normal range, our results showed that the normal range of fundal height was 27 to 35 centimeters. For a fundal height measurement outside of this range, an abnormal and a high-risk delivery should be expected.

Keywords • birth weight • fundal height • low birth weight • macrosomia

Introduction

Weight is the most crucial factor for predicting risk of mortality and morbidity of neonates during their first year of life.1 Estimating fetal weight antenatally is crucial for two reasons: 1) planning preventive measures when the obstetrician predicts an unwanted situation such as respiratory distress syndrome (RDS) or hypoglycemia in a low birth weight (LBW) neonate. Obstetricians can reduce the risk of mortality and morbidity of the mothers and neonates by referring them to a tertiary level medical center1; 2) managing the delivery and making appropriate decisions for the ensuing situation. 2 3

Different methods exist for estimating birth weight (BW) and there are several different measuring methods, such as palpation the fetus through the mother's abdominal wall, fundal height measurement (FHM) and estimating fetal weight by ultrasound in small for gestational age (SGA) or preterm fetuses.1 Several studies show that FHM is comparable to other methods in estimating birth weight and weight of the fetus at the time of the exam3-8

We conducted this study to determine the relationship between FHM and actual birth weights.
Patients and Methods

Based on our estimate and to obtain 75% correct estimation with 4% accuracy, 450 pregnant women who were hospitalized for labor pain, premature rupture of membrane, severe pre-eclampsia and other labor-related emergencies in Imam Khomeini and Shariati Hospitals in Tehran, Iran, during the spring and summer of 2000 were enrolled in this study. They were the first 450 consecutive patients who fitted the selection criteria.

Mothers with any type of systemic disease (e.g., diabetes mellitus, hyper- or hypothyroidism, renal or heart failure, poly or oligohydramnios, placental abruption, maternal weight greater than 91 kg, uterine anomalies, documented fetal congenital anomalies, and twin or multiple fetuses were not included in the study. Non-cephalic birth presentation and stillbirth (intrauterine fetal death) were also considered as exclusion criteria. We included only those mothers whose delivery occurred within 5 days of performing FHM.

FHM was performed according to a standard method by trained personnel. Fundal height (FH) was defined as the distance between the uppermost part of the pubic symphysis to the uterine fundus, which was determined by palpation and percussion.

All patients had urinated within the half an hour prior to FHM. Most of the measurements were performed during labor between uterine contractions and a few prior to labor but within 5 days of parturition. The parturient women were in the supine position with slight flexion of the knees. The breathing patterns of the mothers were normal and their abdomens were relaxed. This method was adapted from Engstorm et al who noted a considerable variation in measurements and recommended a uniform method for measurements. The examiners, who were unaware of the parturient gestational age, measured FH and entered it in a datasheet. Actual birth weight (± 10 g) was entered into the same form after delivery. This form included also some demographic data about the patients.

Using SPSS version 10.01, regression analysis was performed to determine the correlation between BW and FH. The best cut-off values of FH for the diagnoses of LBW and macrosomia were determined. The positive predictive value (PPV), negative predictive value (NPV), sensitivity and specificity of FHM were calculated. The actual birth weights of the neonates were obtained by weighing all neonates on the same scale. A difference of less than 1 pound (453 g) between the estimated weight (EW) and the actual BW was defined as a correct estimation.

Results

The mean (± standard deviation [SD]) age of the parturient patients was 26 ± 5.3 years (range, 15–43 years). FHs ranged from 146 to 395 mm (mean ± SD = 290.8 ± 46.7 mm). One hundred and one neonates had LBWs (< 2,500 g) and 13 of the neonates weighed over 4,000 g (macrosomia) (Figure 1). There was a positive correlation between BW and FH, as shown by the regression analysis (Figure 2).

We made a correct estimation of BW in 349 (77.5%) of 450 cases. The difference between the EWs and actual BWs ranged from -898 g to +692 g. Among neonates with LBW, the EW was greater than the actual BW, so the difference produced a negative value. At 2,935 g, the difference was zero. Conversely, the difference was a positive value in the neonates whose weights were above this critical cut-off point (Table). FHs of 258 mm and 371 mm correlated to BWs of 2,500 g and 4,000 g, respectively.

The specificity of the EW was 91.5% when the actual BW was in the normal range (2,500 g to
Table. Fundal height (FH) and birth weight (BW) measurements in 450 women hospitalized in Imam Khomeini and Shariati hospitals

<table>
<thead>
<tr>
<th></th>
<th>Mean ± SD</th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>FH (mm)</td>
<td>290.8 ± 46.7</td>
<td>146</td>
<td>395</td>
</tr>
<tr>
<td>BW (g)</td>
<td>2,931.4 ± 713.4</td>
<td>640</td>
<td>4,620</td>
</tr>
<tr>
<td>Estimated weight (EW) (g)</td>
<td>2,931.5 ± 622.6</td>
<td>1,002.1</td>
<td>4,320.7</td>
</tr>
<tr>
<td>Difference between EW and BW</td>
<td>-6.9 ± 348.2</td>
<td>-898</td>
<td>692.1</td>
</tr>
<tr>
<td>Absolute value of difference between EW and BW (g)</td>
<td>291.3 ± 190.3</td>
<td>1</td>
<td>898</td>
</tr>
<tr>
<td>Difference between means of EW and BW in neonates weighting less than 2,935 g</td>
<td>-136 ± 342.5</td>
<td>-898</td>
<td>598.4</td>
</tr>
<tr>
<td>Difference between means of EW and BW in neonates weighting more than 2,935 g</td>
<td>101.1 ± 317.1</td>
<td>-627.7</td>
<td>692</td>
</tr>
</tbody>
</table>

Discussion

Review of the literature shows several important points regarding FHM. Ansarian et al proved that different methods of measuring BW yielded similar results. In a study from Malaysia of 506 pregnant women, in 82.5% of women the difference between the EW and real BW was less than 1 pound. We found that FH was positively correlated to actual BW (r = 0.88). This correlation coefficient is greater than those of other studies (0.6–0.7). We tried to consider all of the known confounding factors for FHM and tried to eliminate their effects on our measurements. Thus, we believe that FHM has adequate precision and accuracy for preparturition estimation of BW. Our frequency of correct BW estimation was comparable to that of other studies.

According to our results, normal FHMs range from 27 cm to 35 cm. Using these two cut-off values, one can predict delivery of LBW (sensitivity: 77%, specificity: 88%) and macrosomic neonates (sensitivity: 69%, specificity: 95%). With LBW infants, PPV will be affected in the positive direction, so that the majority of such cases can be diagnosed prenatally. In support of idea of FHM for the diagnosis of LBW we also refer to studies in which the sensitivity and specificity of FHM for the diagnosis of SGA neonates were around 80% and 90% respectively.

Labrecque and Boulianne found the best cut-off value of FHM for determining LBW was 31 cm. Two studies, one from Australia and the other from Malaysia, indicated that estimating BW by FHM had a tendency toward over estimation of birth weight in LBW cases. The converse was true for neonates with macrosomia in both studies. We
found that the frequency of correct BW estimation in multiparous women was greater than in nulliparous women. This difference might be attributed to greater laxity of the abdominal wall and feasibility of palpating the uterine fundus more easily in multiparous parturient women.

We recommend that primary health care providers to pregnant women become familiar with this valuable measurement and its cut-off values for early diagnosis of high-risk pregnancies.

References