Original article:

Comparative study between fetal weight assessment by clinical methods versus ultrasonography

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ABSTRACT

Introduction: A quick, easy and accurate estimation of foetal weight in utero is of paramount importance and it is beneficial to the clinical practitioners in obstetrics. Estimated fetal weight was incorporated as a standard routine for antepartum evaluation of high risk pregnancies and deliveries, mainly in management of diabetic pregnancy.

Aims and Objective: To compare the accuracy of clinical methods by using Johnson’s formula and Dares equation with ultrasound and comparison of predictive values by each technique with actual values of baby-weight and to know accuracy and sensitivity of each technique.

Methods: This prospective comparative study was carried out in 100 pregnant females who fulfilled the inclusion criteria of singleton pregnancy, cephalic presentation, term pregnancy and who had interval of less than 48 hours between examination and delivery.

Results: The percentage error of clinical method was smaller i.e. (1.4% by Johnson’s method and 1.8% by Dare’s equation) than sonographic method (i.e. 3%) in the birth weight group of 2500 to 3500 gms. In the birth weight group <2500 gms the percentage error of sonographic estimates was significantly smaller (i.e. 0.9%) as compared to clinical estimation (i.e. 6.8% by Johnson’s method, and 4.6% by Dare’s equation) and in weight group >3500 gms there was no statistically significant difference. No statistically significant difference was observed in all the measures of accuracy for the normal range of birth weight i.e. 2500 – 3500gms.

Conclusion: Study concluded that clinical estimation of birth weight is as accurate as routine ultrasonography estimation, except in babies weighing smaller than 2500 gms and subsequent sonographic estimation is recommended to yield a better prediction and to further evaluate foetal well being.

INTRODUCTION

Accurate estimation of fetal weight has a paramount importance in the management of labour and delivery. During last decade, estimated fetal weight was incorporated as a standard routine for antepartum evaluation of high risk pregnancies and deliveries, mainly in management of diabetic pregnancy, Vaginal birth after caesarean section and intrapartum management of fetuses with breech presentation. When dealing with anticipated preterm delivery for perinatal counselling on likelihood of survival or intervention taken to postpone the delivery, optimal route of delivery or place at which delivery should occur is partly or wholly dependent on estimated baby weight.

It was estimated that in India one third of live born infants have low birth weight.¹ Low birth weight...
weight is a major problem in India, nearly 3 million low birth weight babies are born annually and it accounts for half of the neonatal deaths. Universally accepted cut off point of birth weight is of 2500 grams to define low birth weight. In India many obstetricians accept the cutoff point of 2250 grams. Incidence of low birth weight in India is 28%. This condition is associated with high perinatal morbidity and mortality. Fetal macrosomia is associated with high perinatal and maternal morbidity. It has been suggested that accurate estimation of fetal weight would help in successful management of labour and care of a new born in neonatal period and help in avoidance of complications associated with fetal macrosomia and with Low Birth Weight babies. Birth weight is very variable from country to country but usually exceeds 2500 Grams. In India weight varies between 2.7 to 3.1 kg as an average of 2.9 kg.

Clinical methods are simple and require no sophisticated instruments. Clinical techniques are mainly based on abdominal palpation of fetal parts and calculations based on fundal height and abdominal girth. Direct measurements of fetal anatomy are possible with the help of modern ultrasonography. Ultrasonographic method relies on linear or planer measurement of in utero fetal dimensions that are definable objectively and should be reproducible. Many sonographic formulae have been devised by several authors, using various parameters like biparietal diameter, head circumference, abdominal circumference, femur length etc.

The available techniques can be broadly classified as:

1) Clinical methods: Tactile assessment of fetal size e.g. Leopalds maneuver.

Clinical risk factor
Maternal self estimated fetal weight and prediction of equations of birth weight.

2) Imaging techniques: Ultrasonography and MRI
All currently-available techniques for estimating fetal weight have significant degree of inaccuracy and various studies have been done to compare the accuracy of different methods of estimation.

This study aims at evaluating the comparative accuracy and sensitivity of clinical methods verses ultrasographic estimation using Hadlocks formula for estimating fetal weight.

MATERIAL AND METHODS
This prospective comparative study was carried out at MGM Medical College and Hospital, Navi Mumbai. It consisted of hundred cases of singleton pregnancies subjected to clinical examination and ultrasonographic examination whose data was collected from 3rd May 2007 to 30th November 2008.

Clinical method
Fetal weight assessment by Johnson's formula

\[
\text{Weight in Grams} = (\text{Fundal Height in centimeters} - \text{N}) \times 155
\]

N = 12 if Head is non engaged.
N = 11 if Head is engaged

Fetal assessment by Dare's equation

Estimated Fetal weight (in grams) = Symphysio Fundal Height \times Abdominal Girth.

Ultrasonographic Methods
Formula for estimating fetal weight devised by Hadlock on basis of Biparital diameter (BPD),
Abdominal circumference (AC), Femur length (FL), and head circumference (HC).

\[
\text{Log 10 EFW (grms.)} = 1.3596 - 0.00386 (AC \times FL) + 0.064 (HC) + 0.00061 \times \text{BPD} \times AC + 0.045(AC) + 0.17 \times \text{(FL)}.
\]

**STATISTICAL ANALYSIS**

At the end of the study, the data was analysed statistically. Accuracy was determined by using percentage error, absolute percentage error, and proportion of estimates within 5% of actual birth weight. Statistical analysis was done using paired ‘t’ test.

**RESULTS**

In study sample, the mean maternal age was 25 yrs. Modal gravidity and parity were primi gravidae and para 1 respectively, 42% of gravidae were nulliparous and 58% were multiparous. Overall clinical method overestimated birth weight while ultrasound underestimated it. The percentage error of clinical method was smaller i.e. (1.4% by Johnson’s method and 1.8% by Dare’s equation) than sonographic method (i.e. 3%) in the birth weight group of 2500 to 3500 gms.

In the birth weight group <2500 gms, the percentage error of sonographic estimates was significantly smaller (i.e. 0.9%) as compared to clinical estimation (i.e. 6.8% by Johnson’s method, and 4.6% by Dare’s equation) and in weight group >3500 gms there was no statistically significant difference.

**DISCUSSION**

Both fetal macrosomia and low birth weight increases the risk of perinatal morbidity and mortality. Identification of intrauterine growth restriction after 37 weeks gestation is an indication for delivery to reduce the chance of fetal mortality. Similarly diagnosis of macrosomia frequently leads to delivery by means of caesarean section to reduce risk of failed vaginal delivery and shoulder dystocia.

The accuracy of clinical estimation obtained in this study was highest in the birth weight range of 2500 to 3500 grams and lowest for the birth weight group of (>3500 grams) as the number of cases in this weight group were less, and it is low for weight group of <2500 grams.

This is in consonance with what several investigators have shown that the clinical method is best for estimating fetal weight in the reference birth weight range of 2500 to 3500 grams with accuracy of 93.67 (i.e. % error of 1.4%) by Johnson’s formula and 90.36 (i.e. % error of 1.8) by Dare’s equation.

Below 2500 grams the accuracy of clinical method deteriorates to 82.35(i.e. error of 6.8%) by Johnson’s formula and 81.25 (i.e. error of 4.6%) by Dare’s equation.

For the ultrasonographic method, results are also consistent with what have been previously observed that the percentage error of estimated birth weight was 3% in 2500 to 3500 weight group but it decreases to 0.9% in <2500 grams weight group.

Clinical estimation of birth weight is as accurate as routine ultrasonographic estimation, except in babies weighing smaller than 2500 gms, subsequent sonographic estimation is recommended to yield a better prediction and to further evaluate fetal well being. Our observation implies that there is clearly a role for clinical estimation of birthweight as a diagnostic tool, suggesting that clinical estimation is sufficient to manage labour and delivery in a term pregnancy.

All the patients delivered within 24 hours of estimation and a wide range of birth weight (1800-4500gms) was estimated among three different races (Malaysians, Chinese and Indians). Results showed that there was no significant difference in estimated baby
weights between three clinicians as well as three sonographic formulas. But clinical estimation was better than ultrasonagrophy in our population, and clinical and ultrasonographic estimates in >4000gms were equally accurate.

This has an important implication for developing countries where there is lack of technologically advanced ultrasound machines capable of doing sophisticated functions like estimation of fetal weight but has experienced clinicians who could perform this function equally well if not better.

The major finding from this prospective study is that clinical estimation of fetal weight is as accurate as the ultrasonographic method of estimation within the normal birth weight range. Although, while the clinical method over estimated fetal weight, our ultrasonic method underestimated it. However, when there is the case of birth weight < 2500 grams the ultrasonic method was statistically more accurate with smaller mean errors and more estimates within ±5% of actual birth weight.

Despite the differences in study design, our findings are in consonance with those reported by others that the accuracy of clinical estimation of birth weight is similar if not better than that of ultrasonic estimation.

<table>
<thead>
<tr>
<th>RANGE</th>
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<tr>
<td>&lt;2500 grams</td>
<td>March 2007</td>
<td>S Shitu et al⁹</td>
<td>Accuracy of clinical method estimates - 41.7%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Accuracy of sonographic method estimates - 66.7%</td>
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<tr>
<td>&lt;3000 grams</td>
<td>March 2007</td>
<td>Peregrine E et al⁸</td>
<td>Accuracy of clinical method estimates - 59%</td>
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<td>Accuracy of sonographic method estimates - 62%</td>
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<tr>
<td>&gt;4000 grams</td>
<td>May 2005</td>
<td>Noumi G et al¹⁰</td>
<td>Accuracy of clinical method estimates - 72%</td>
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<td>Accuracy of sonographic method estimates - 74%</td>
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<td>&gt;2500 grams</td>
<td>March 2002</td>
<td>Baum J D et al¹¹</td>
<td>Accuracy of Clinical method estimates - 64%</td>
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<td></td>
<td></td>
<td>Accuracy of sonographic method estimates - 62.5%</td>
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<td>690-5320 grams</td>
<td>February 1998</td>
<td>Sherman D J et al¹²</td>
<td>Accuracy of clinical method estimates - 72%</td>
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<td></td>
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<td>Accuracy of sonographic method estimates - 69%</td>
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**CONCLUSION**

The role for ultrasonographic estimation appears that, when clinically estimated weight suggests weight less than 2500 grams, subsequent sonographic estimation would yield a better prediction and would be further necessary to assess such fetuses for congenital malformation and to do the biophysical profile to determine the well-being of the fetus.

We regard the over estimation of fetal weight by the clinical method as a positive factor.
since it will enhance the sensitivity of health workers at peripheral centers, if properly taught to them for earlier referral of mothers with macrosomic fetuses, thus contributing to reduction of obstructed labour and its sequale.

REFERENCES