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Estimation of fetal weight by clinical method and its comparison with ultrasonography and its correlation with actual birth weight in term singleton pregnancy

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ABSTRACT

Background: Not just in the management of labour and delivery, but also in the treatment of high-risk pregnancies and growth tracking, fetal weight assessment is important.
Objective: This study is to determine which method of fetal weight estimation is more accurate which helps inappropriate decision making as ultrasound is not readily available in case of emergencies and also it is an additional burden on sonologist during emergencies.
Materials and Methods: This prospective comparative study was carried out at the Obstetrics and Gynecology Department and Radio-diagnosis of GSL Medical College from September 2020 to February 2021.
These clinical and ultrasonographic fetal weights are compared with actual weights.
Results: 2 patients delivered babies with actual birth weights in the range of 1.5-2 kg, 13 patients g between 2.1 and 2.5 kg, 29 patients between 2.6-3.0 kg, 21 patients between 3.1 and 3.5 kg and 5 patients between 3.6 and 4.0.kg.
Hadlock's and Dare's equations anticipated mean birth weights of 2.90 and 3.07 kg, respectively.
Conclusion: Studies indicated that ultrasonographically estimated fetal weight is no better than the clinical for predicting fetal weight. Clnical estimates appear to be as accurate as ultrasonographic estimates where ultrasound is not available.

1. Introduction

Assessment of fetal weight is a vital and universal part of antenatal care not only in the management of labor and delivery but during the management of high-risk pregnancies and growth monitoring.[1]

The birth weight of an infant is the single most important determinant of newborn survival. Both low birth weight and fetal macrosomia at delivery are associated with an increased risk of complications during labor.[2]

Birth weight has been an important predictive parameter of a neonatal outcome as the incidence of low five-minute APGAR scores, severe fetal acidemia, and seizure during the first 24 hours after the delivery was shown to be higher in neonates with weight below the third percentile.[3]

In cases of breech presentation, previous cesarean section, suspected macrosomia, IUGR, and preterm deliveries, as well as medical problems aggravating pregnancies including gestational diabetes mellitus and preeclampsia, estimating fetal birth weight is very important.[4]

In high-risk pregnancies and births, estimated fetal weight is now part of the regular antepartum examination.[5]

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Ultrasonography includes evaluation of several parameters of fetal skeletal parts, and clinical approaches include abdominal palpation of fetal parts and fundal height measurement.[6]

By Leopold's maneuver the examiner can characterize the position of the fetus as well as the level of the uterine fundus by placing both hands on the woman's abdomen, and can discover a disproportion between the fetus and the female pelvis. After conducting Leopold's techniques, such as symphysio-fundal height and abdominal palpation, experienced examiners can give a clinical estimate of fetal weight.[7]

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While ultrasound estimation of fetal weight is reliable to a degree, it has a margin of error ranging from 6%-11%, depending on the characteristics measured.[8]

The accuracy of EFW is influenced by the maternal body mass index (BMI). Clinicians should be aware of the limitations of sonographic estimation, particularly in obese patients, as measurement deviation is higher in pregnant women with a BMI>25 kg/m2.[9]

2. Materials and Methods

It was a prospective study conducted at GSL Medical College and General Hospital, Rajahmundry from September 2020 to February 2021.

2.1. Sample size

70 cases.

2.2. Inclusion criteria

1. All pregnant women above 18 years of age attending ANC OPD.
2. All women with a term singleton pregnancy with cephalic presentation.
3. All pregnant women coming in early stages of labor.

2.3. Exclusion criteria

1. Pregnant women with fetal congenital anomalies.
2. Pregnant with multiple pregnancies.
3. Pregnant women coming in late phases of labor.
4. Malpresentation.
5. Pregnant women with a pelvic mass.
6. Intra-uterine death.
7. Polyhydramnios / oligohydramnios.

2.4. Objectives

1. Estimation of fetal weight by clinical method and ultrasonography.
2. Correlation of these estimated birth weight with actual birth weight.
3. To determine which method of fetal weight estimation (clinical or sonographic is more accurate.

2.5. Methodology

Clinical estimation of fetal weight by Dare's formulae.

After emptying her bladder and, and correcting dextrorotation of uterus, a clinical weight estimate was performed. The mother was requested to lie down supine with her legs extended, and her symphysio-fundal height(SFH) was measured using a tape before birth and at the level of the umbilicus, the abdominal girth was measured. Participants and case files are asked about their age, last menstrual period, gestational age and parity.

2.6. Dare's formulae

Weight in grams = Abdominal Girth (centimeters) x Symphysiofundal Height(centimeters).

2.7. Hadlock's formula

After the Head Circumference (HC), Abdominal Circumference (AC), and Femur Length (FL) of the fetus was measured in centimeters, the sonography machine calculates the fetal weight.

Log (10) BW=1.335-0.0034 (abdominal circumference) (femur length) +0.0316(bi-parietal diameter) +0.0457(AC)+0.1623(FL).

In a chart, both clinical and ultrasound estimates were recorded. The baby's birth weight was calculated within 30 minutes after delivery using a conventional analogue scale.

Percentage error, absolute error, and proportion of estimations within 10% of actual birth weight were used to assess the accuracy of clinical or sonographic fetal weights versus the actual birth weight.

Percentage error of the method was calculated using the formula – percentage error = x/ A X 100;

Where x = error in grams, A = actual birth weight.

These clinical and ultrasonographic fetal weights are compared with actual weights and statistical analysis was performed by SPSS software trial version MS EXCEL 2007. Descriptive statistics were presented as Mean+SD and percentages.

Correlation by Karl Pearson coefficient of correlation to find the correlation between variables. For all statistical analyses p-value, greater than 0 were considered statistically significant.

2.8. Ethical considerations

Information on the study was given to the participants who decided whether or not to enroll in this study, after the approval by the Hospital Research and ethics committee. Informed consent was obtained from all participants before the study.

3. Results

Table 1: Distribution of subjects based on gestational age: Most of the females are between 39-40 weeks of gestation

Gestational age in weeks	No of subjects	Percentage
37-38	25	36
39-40	41	58
>40	4	6

This is a pie diagram showing the distribution of participants based on gestational age.

Out of 70 pregnant women examined most of the study group were between 20-25 years of age (58%) with mean maternal age was 22.4+-2.3 years.

Table 2: Distribution of subjects based on age of mother

Age of mother	No of subjects	Percentage
20-25 years	40	58
26-30 years	21	30
30-35 years	9	12

3.1. Distribution based of parity of subjects

Out of 70 members, 32 are nulliparous and 38 are multiparous women. A maximum number of participants are Primigravida 45% followed by 2^{nd} gravida accouting for 33%.

Table 3: Distribution based of parity of subjects

Gravida	No of pregnants	Percentage
Primigravida	**32**	**45**
2nd Gravida	23	33
3RD Gravida	10	15
4TH Gravida	5	7

A total of delivered by cesarean section and had delivered by normal vaginal delivery. The meantime between the estimation of fetal weight and delivery was 52 hours+- 2.20 hours.

The average birth weight was 3.1 kg, with 22%(15%) of babies having a low birth weight (less than 2500gms) and 78% having macrosomia (2500-4000 kg).

Two patients delivered babies with actual birth weights in the range of 1.5-2 kg, accounting for 3% of the total of 70 participants evaluated.

Table 4: Distribution of subjects based on birth weight of baby

Birth weight in KG	No of subjects	Percentage
1.5-2.0	2	3
2.1-2.5	13	19
2.6-3.0	29	41
3.1-3.5	21	30
3.6-4.0	5	7
Total	70	100

Thirteen pregnant women gave birth to babies weighing between 2.1-2.5 kg, accounting for 19% of the total. A total of 29 pregnants delivered babies weighing between 2.63.0 and 2.63.0 kg, accounting for 41% of the total. A total of 21 pregnant women delivered babies weighing between 3.1-3.5 kg, accounting for 30% of the total. 5 pregnant women gave birth to babies weighing between 3.6-4.0 kg, accounting for 7% of all births.

Table 5: Distribution of subjects based on mean birth weight predicted by had lock's and dare's formulae and actual mean weight in KG

Birth weight	Mean	Median	SD	Minimum	Maximum
Hadlock Formula	2.92	2.92	0.39	1.50	3.80
Dare's formula	3.06	3.14	0.45	1.69	3.89
Actual weight	3.02	3.04	0.49	1.60	3.80

Hadlock's and Dare's equations anticipated mean birth weights of 2.92 and 3.06 kg, respectively. 3.02 kg was the average actual birth weight. This demonstrates that USG-based formulas estimate foetal weight on the low end, whereas clinical formulas predict foetal weight on the high end. Dare's and Hadlock's equations had mean errors of -2.09 percent and -3.56 percent, respectively. The mean inaccuracy in grams was -60gm and -110gm, respectively.

According to Dare's formula only one baby was anticipated to be under 2.5kg, whereas 89 percent were between 2.5-4kg at birth. As a result, it predicts a somewhat higher weight. According to Hadlock's calculation, 75% of the babies were expected to weigh between 2.5-4kg, with only one anticipated to weigh more than 2.5kg. It forecasts the weight to be slightly higher.

Table 6: Distribution of subjects based on BMI

BMI(kg/m2)	No of subjects	Percentage
Less than 18.5	4	5.7
18.5-22.9	25	35.7
23-24.9	18	25.7
More than 25	23	32.8

Mean birth weight increases with maternal weight. Out of 70 members, 23 of them with BMI>25 were delivered with mean actual birth weight.

Table 7: Assessment of co-relation between actual birth weight and birth weight as per various predictors

Birth weight (Kg)	P-value	Hadlock's r- value	Dare's P-value	Dare's r- value
1.5-2.0	0.63	<0.01	0.67	<0.01
2.1-2.5	0.73	<0.01	0.75	<0.01
2.6-3.0	0.74	<0.01	0.82	<0.01
3.1-3.5	0.70	<0.01	0.81	<0.01
3.6-4.0	0.65	<0.01	0.72	<0.01
Overall	0.72	<0.01	0.77	<0.01

Both Dare's and Hadlock's formulae shows good correlation with actual birth weight($p<0.05$) with the best correlation observed at a weight range of 2.5-3.5kg. Correlation was slightly lower at extremes of weight at both the ends.

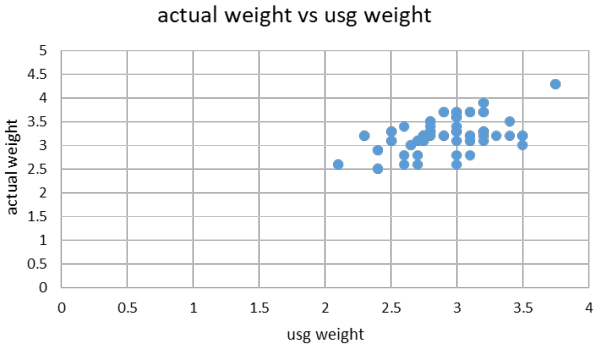

Fig. 1: Actual birthweight vs prediction by hadlock's formulae

The association between actual birth weight and ultrasound fetal weight is depicted in a scatter diagram. The ultrasonography approach had a positive association with the fetus's actual birth weight. It demonstrates a straight line relationship.

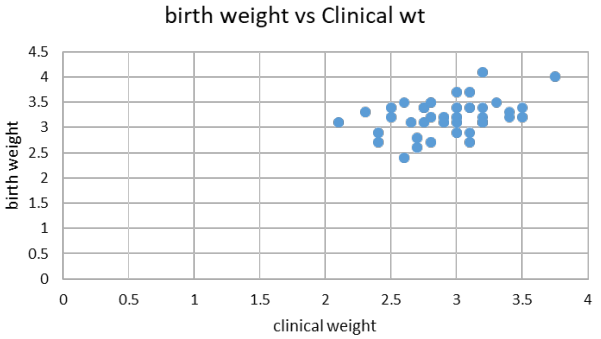

Fig. 2: Actual birthweight vs prediction by dare's formulae

The association between actual birth weight and clinical fetal weight is depicted in this scatter figure. It demonstrates a straight line relationship.

4. Discussion

The birth weight of a baby has a big impact on fetal and neonatal morbidity. Intrauterine growth restriction and macrosomic fetuses induce long-term neurologic and developmental abnormalities and raise the risk of perinatal morbidity and mortality.

After 37 weeks of pregnancy, intrauterine growth restriction is an indication for delivery to lower the risk of fetal mortality. In the same way, a diagnosis of macrosomia often leads to a caesarean section to avoid the risk of a failed vaginal delivery and shoulder dystocia.[10]

Other nonstandard sonographic parameters utilized include humeral soft tissue thickness and cheek-to-cheek distance. These nonstandard measurements do not improve the effectiveness of sonography to predict birth weight, except in rare cases such as diabetic mothers.[11]

The anterior placenta, maternal obesity, and oligohydramnios are all technical restrictions for sonographic fetal weight estimates. Other downsides of ultrasonography include its complexity and labor-intensive nature, as well as its limited view of fetal components.

In routine obstetric practice, clinical examination is done by measuring the symphysio-fundal height at each antenatal visit similar to a study done by Ingale A et al.[11]

In this work, we compared clinical and sonographic methods of predicting fetal weight prospectively at term and found that clinical appears to be as accurate as ultrasonographic approaches, which is similar to the findings of Dare et al., Avirupa Guha Roy et al,[12] and Ingale A et al.[11]

Ultrasonography has become the recognised method for estimating fetal weight in most centres. Johnson's and Dawn's formulas for estimating clinical birth weight are now obsolete. Because ultrasound is limited to a few secondary and tertiary care centres in poor economic countries like ours, and affordability is an issue before recommending an investigation, clinical birth weight estimation may be an alternative tool to screen patients who are likely to have complications associated with pregnancy.

According to Hadlock's calculation, 75% of the babies were expected to weigh between 2.5-4kgs, with only one anticipated to weigh more than 2.5kg. It suggests a weight that is slightly below average.

The finding that ultrasound overestimated lower birth weight groups and underestimated higher birth weight groups when compared to ABW has also been previously established.[10]

Dare's and Hadlock's equations projected mean birth weights of 3.07 and 2.90kg, respectively, in the current study (p-0.45; non-significant). 3.01kg was the average actual birth weight.

Dare's and Hadlock's formulas both show a good connection with actual birth weight across all weight ranges (r- 0.77 and 0.72; p0.05 for both), with the strongest association observed at a birth weight of a hundred pounds. In the present study, the mean error (%) in predicting birth weight by Dare's and Hadlock's formulae was -2.09% and -3.56% while the mean error, as measured in grams, was 60.0 gm and -111.0 gm respectively. This shows that USG based formulas predict the fetal weight on the lower side while clinical formulae predict it slightly on the higher side.

For clinical fetal weight estimation, this study only used Dare's formula.

The sample size was modest, and it was based on only one hospital; a larger sample size with a multicentric study would be better for determining the clinical and ultrasound weight estimation's true diagnostic value. Due to the small number of underweight and macrosomic newborns in this investigation, the diagnostic value for detecting underweight and macrosomic fetuses could not be predicted.

The study's main finding is that clinical fetal weight estimation is as accurate as ultrasonographic foetal weight estimation within the normal birth weight range. Our findings are significant because ultrasound is not widely available in many health-care delivery systems in developing countries like ours, particularly in rural areas

5. Conclusion

Our findings imply that clinical assessment of birth weight can be used as a diagnostic tool, and that clinical estimation is sufficient for managing labour and delivery in a term pregnancy.

Except with low-birth-weight newborns, clinical birth weight assessment may be as accurate as regular ultrasonographic measurement. As a result, if the clinical method indicates a weight less than 2,500 g, further sonographic estimation is recommended to provide a more accurate prediction and to assess fetal well-being.

This study found that clinical birth weight estimation can help manage labor and delivery in a term pregnancy, even in developing country like India.

Recommendation that all health care personnel be taught how to estimate fetal weight as a normal screening protocol for all pregnant women.

6. Source of Funding

None.

7. Conflict of Interest

None.

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