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Comparison of estimation of fetal weight by two clinical methods and ultrasound at term pregnancy

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Abstract
Objective: To make a comparative evalution of estimation of fetal weight in term pregnancy by using USG and Johnson's formula and Dare's formula.
Methods: The fetal weight in –utero was calculated by using the above methods in 600 pregnant women at term. The results were correlated with actual birth weight. Comparative analysis of the accuracy of the various methods was done.
Results: It was seen in this study that clinical methods can reliably estimate EFW and can be used in settings where USG is not available. Dare's formula EFW correlated closely to TBW as compared formula. Estimates were obtained using Johnson's formula and Dare 's formula**.**
Conclusion: Both groups had least average error, Dare's formula EFW concurred with true birth weight with minimal error.

Keywords: term pregnancy, ultrasound, fetal weight

Introduction

Accurate estimation of fetal weight is one of the important aspects in management of labour. Its needs to be emphasized that the birth weight is an important parameter for perinatal morbidity and mortality. It is important is, making the diagnosis of both intrauterine growth restriction and fetal macrosomia.

Estimation of expected fetal weight helps to determine the deviation of fetus from normal growth. It helps in deciding the mode of delivery and predict intranatal complication like shoulder dystocia. Estimating fetal weight is also important when dealing with preterm births where counselling regarding the prognosis, survival of the newborn and need for intensive care depends on fetal weight [1].

Abnormalities in fetal growth can be detected clinically or by ultrasound. Simple methods like measurement of symphysio-fundal height and abdominal girth can be used to predict expected fetal weight in low resource settings.

Ultrasound is also used for estimation for expected fetal weight and diagnosis of impaired growth. But, it is not easily available in all places offering obstetric care, especially in low resources settings. Fetal weight estimation using ultrasound needs training, expertise and an expensive equipment. In such circumstances clinical methods of estimating fetal weight can aid in obstetric decision making [2] Therefore, development and validation of simple, inexpensive, accurate and effective clinical methods are important and relevant especially in countries like India, where equipment and trained manpower are scarce at most places of delivery.

Various clinical formulae based on measurements of symphsio-fundal height and abdominal girth have been developed. Johnsons formula for estimating fetal weight in vertex presentation was developed.

The other methods of fetal weight estimation VIZ. Clinical palpation and dawn`s formula have been found to be inaccurate due to inter-observer variation. Therefore, in our study, we have studied 600 full terms pregnancies in early labour. Induction of labour or elective LSCS to compare the accuracy of the two clinical formulae VIZ. Johnson`s and Dare`s formula to estimate the fetal weight in comparison with ultrasound estimated fetal weight and actual birth weight [3].

Material and Methods

The study is statically approved by institutional review board of Index Medical College and Research Centre, Indore.

- **Study design**: prospective study
- **Sample size**: 600
- **Study Duration**: June 2016 TO November 2016

Statistical Analysis

$$\text{Formula Used} = n = \frac{p(1-p)z^2}{d}$$

Source of Data Collection

All women during pregnancy who came to the labour ward in early labour or for induction of elective LSCS at INDEX HOSPITAL, INDORE were included in the study.

Women who presented to labour room where screened for enrolment in the study using inclusion and exclusion criteria informed consent was obtained a signature or left hand thumb impression from the consented subject was obtained after reading the informed consent document. No monitory benefit

was offered to any of the participant enrolled in the study.

Methods of Data Collection

The following were the **inclusion**

1. Age more than 18 years.
2. Singleton pregnancy
3. Cephalic presentation
4. Live fetus
5. Known last menstrual period or scan with continued expected date of delivery
6. Gestational age ≥37 weeks and ≤42 weeks.
7. Admission of subject in early labour or for induction of labour elective caesarean –section with in one week of admission.

The following were the exclusion criteria:

1. Multiple gestation
2. Non-cephalic presentation
3. Anomalous fetus
4. Intrauterine fetal death
5. Presence oh co-existing fibroids, ovarian cysts
6. Already diagnosed liquor abnormalities

At admission, height and weight were recorded and body mass index was calculated. After a brief general physical examination, per abdominal examination was performed in supine position. Patient was asked to empty the bladder before examination the uterine height was palpated from xiphisternum downwards after correction of dextro-rotation of the uterus. Upper border of pubic simphysis was palpated and the symphysio- fundal height in centimetre was measured using flexible standard measuring tape with the marking of cms. Towards the patient and keeping the measuring tape in the skin contact. This was followed by measurement of abdominal girth in centimetre at the level of umbilicus.

Expected fetal weight was calculate using two clinical formula, Johnson`s formula and Dare`s formula.

This was for estimation of fetal weight by ultrasound. The ultrasound was performed using C 2-5 transabdominal curvilinear probe on Philips HD 11 machine. To avoid inter-observer variation, ultrasound done by four obstetricians trained in performing ultrasound was taken for the study. Biometry of the fetus was taken using the following parameters; bi-parietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femoral length (FL).

Bi-parietal diameter was measured at the level where both thalami and cavum septum pellucidum were visualized. mBPD was measured from inner to outer table of the skull bones. Head circumference was measured in the same plane. Abdominal circumference was measuered at the level of bifurcation of the hepatic vein into right and left branches. Femoral length was measured with the femur excluding the femoral head and the epiphysis along the vertical axis seen transversly. Expected fetal weight was obtain using *mediscan* software device and HADLOCK formula. The expected fetal weight was obtained by in built *software*. This was also combined with measurement of liquor. All women enrolled in the study, deliverd within two days from the time of estimation of fetal weight by clinical and USG methods. This was important as the fetus in –utero continues to grow with weight gain of 30 – 35 gms per day at term.

The patient was delivered either by vaginal route or by lower segment caesarean section. The maximum delivery interval after USG and clinical estimation was 48hrs.After birth, the actual birth weight was measured using standard digital weighing machine approved by ISI. The scale was corrected for zero error. The expected fetal weight by clinical formulae and ultrasound was compared with the actual birth weight. The average error, maximum error, percentage error and standard deviation of estimation of fetal weight in comparison with true birth weight was calculated both for clinical and ultrasound method.

Johnson Formula

= Fetal weight (gm) =155× (fundal height –x) x155

Where x =11 at plus station,

=12 at zero station

= 13 at minus station

Dare's Formula = Fetal weight (gm) = SFH x AG

Results

- There were 45% of women were primigravida and 55% were multigravida.

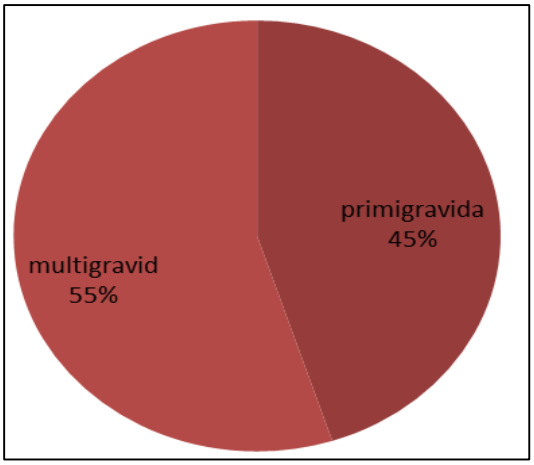

Fig 1

- The mean maternal weight was 61.5±6.23kg. The mean maternal height was 1.51 ±0.41mts.
- Case according to birth weight, shown in Table :1

Table 1

case distribution according to birth weight

	BIRTH WEIGHT IN GMS	NO.OF CASES	percentage
1	<2000gms	12	2.10%
2	2001-2500 gms	120	20%
3	2501-3000 gms	310	51.60%
4	3001-3500 gms	135	22.50%
5	>3500 gms	23	3.80%

- Average error in various fetal weight groups by two clinical methods and USG in (gms). The mean average error represents the sum of the positive (over estimation) and the negative (under-estimation) from actual birth weight.

Table 2

TRUE BIRTH WEIGHT	<2000	2001-2500	2501-3000	3001-3500	>3500	ALL CASES
Johnson's formula	347.5	227.7	124.8	172	304.2	167.6
DARE'S Formula	237.5	115.6	86.1	135.2	254.2	111.4
USG	335	202.1	123.1	143.3	327.1	155.9

- Percentage error in various fetal groups shown in Table :3

Table 3

% error	Johnson's formula	Dare's formula	USG
Upto5%	51%	72%	58.5%
Upto 10%	81.5%	95.5%	82%
Upto 15%	93%	98.5%	90.5%
Upto 20%	96.5%	99.5%	98%
Upto 25%	99%	100%	100%

In 95% of the cases. USG correlated well with TBW with error of 15%.This was in consonance with Dare's formula weight which was also between 10-15% of the TBW. The error was more for Johnson's formula with 95% of cases with error of 20%.

- Standard Deviation of predicted error of the various methods shown Table :4

Standard deviation was calculated using the mean of errors for each of the methods. It was found that the least deviation was for the Dare's formula with 120.8gms, closely followed by USG with 142.8gms. Johnson's formula had maximum deviation with 175.1gms

Table 4

Methods of fetal weight estimation	Standard deviation of predicted
Johnson's Formula	175.17
Dare Formula	120.8
USG	142.81

Table 5: Distribution of patient by different categories of BMI

Group	Bmi	Percentage
1(normal BMI)	19.9-24.9KG/m^2	44%
2-(Lean)	<19.8 kg/m^2	35.2%
3-(over weight)	25-29.9kg/m^2	15.4%
4-(obese)	>30 kg/m^2	5.5%

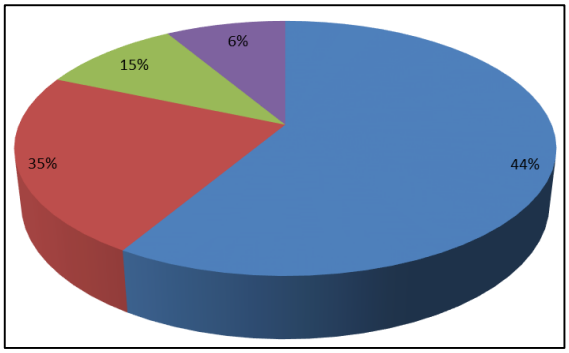

Fig 2

Discussion

Estimation of EFW has become increasingly important for obstetric decision making regarding. Induction of labour; evolution of feto- pelvic disproportion, mode of delivery especially in vaginal birth. After C-section (VBAC), detection of IUGR.

The ultimate aim of obstetric practice is delivery of a healthy baby with least amount of maternal morbidity. Birth weight assumes importance in that its accurate estimation in –utero gives a fairly good estimate of the neonatal outcomes.

In our study we have attempted to compare 2 clinical formulae and ultrasound EFW with TBW. The compression was done by calculating the following-

1) **Average error –** Average error in weight group of USG was significantly less in comparison with Johnson`s` formula with mean average error of 155.9 gms. Johnson`s formula had a mean average error of 167.6 gms. the average error by Dare`s formula EFW was maximum in fetal weight of more than 3500 s gms and least in less than 2500 gms.
2) **Maximum Error-maximum error was with** JOHNSON`s formula. Again Dare`s formula seen to better with less error than other formula with was comparable with USG, EFW.
3) **Percentage Error-** In the present study, Dare`s formula and USG had error around 15% in 95% of cases, whereas Johnson`s formula head error of 20% in 95% of cases.
4) **Standard Deviation Of Prediction Error-** The standard deviation was minimal for Dare`s formula EFW followed closely by USG with difference of 20.2 gms. The maximum standard deviation was present for Johnson's formula.

Hence, the USG derived EFW became widely used as it was more objective and reproducible.

In our study, we used standardized method of clinical estimation using tow formula that were used for fetal weight estimation. the ultrasound fetal weight estimation was done using mediscan software and headlock`s formula by obstetricians trained in USG.

The major finding from this study is that the clinical estimation of fetal weight by Dare`s formula is as accurate as USG estimation of EFW within birth weight range of 2500gms to 3500gms USG estimates were more accurate in weight <2300 gms.

Our study implies that there is clearly a role for EFW estimates by clinical formulae suggesting that clinical estimation is sufficient in estimating EFW and manage labour delivery in term pregnancies. USG being indicated only where there is clinical disparity of gestational age and EFW.

Strength of the Study

Our study was condected in Tertiary care hospital with USG being done on Philips HD 11 machine witch has excellent resolution and hence the prediction of birth weight was closed accurate. The clinical estimation of fetal weight was done by residents in the labour room the result of which were not disclosed to the person performing the USG.

The patients who had an USG report done in the week prior to delivery or those who came ill early labour were included. This was to avoid the wrong measurements of the BPD and AC when the fetal head was deeply engaged. Patients having

liquor abnormalities were excluded to avoid the confounding in SFH measurements.

Conclusion

This study was an attempt to observe if simple, inexpensive and easy to teach clinical methods can be used in peripheries where expensive USG equipment and expertise professional are a dearth. The clinical estimation of fetal weight was done by measuring the SFH and AG. Estimates were obtained using Johnson's formula and Dare's formula. It was seen in this methods can reliably estimate EFW and can be used in settings where USG is not available. USG was only needed when there clinical suspicion of IUGR or LBW or fetal macrosomia.

Jhonson`s formula and USG both had tendency to over-estimate fetal weight. In the 2501-3500 groups USG and Dare's formula EFW concurred with true birth weight with minimal error. Both groups had least average error. Since majority majority of the normal term pregnancies fell in this group and it was reasonably accurate (Dare`s formulae >Johnson`s formula) with the USG weight. Clinical methods can be used in clinical practice where no USG facilities are available.

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