A PROSPECTIVE AND COMPARATIVE STUDY OF ESTIMATION OF FOETAL BIRTH WEIGHT CLINICALLY AND SONOGRAPHICALLY AND ITS CORRELATION WITH ITS ACTUAL BIRTH WEIGHT

Gynaecology

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ABSTRACT

BACKGROUND: Knowledge of fetal weight in utero is vital for the obstetrician in deciding whether to deliver the fetus as well as in fixing the mode of delivery. Both low birth weight and excessive fetal weight at delivery are associated with increased risk of newborn complications during labor and the puerperium. During the last decade, estimated fetal weight has been incorporated into the standard routine antepartum evaluation of high-risk pregnancies and deliveries. Objective of present study was to assess the fetal weight in term pregnancies by Clinical and Sonographic and to compare the methods after knowing the actual weight of the baby after birth. **METHODS:** It is a prospective and comparative study of 100 women at term pregnancy at Obstetrics and Gynaecology Department of Madhubani Medical College and Hospital, Madhubani, Bihar from 20th March 2020 to 31st October 2020. Patients within 7 days from their Expected Date of Delivery were included in the study. The formulas used in this study are: Johnson's formula, Dare's formula and Hadlock's formula using ultrasound. **RESULTS:** Results vary in terms of accuracy with various methods employed for estimating the fetal weight. This study showed that Dare's Formula was the best indicator among all other methods assessed followed by Hadlock's formula by ultrasonographic method. **CONCLUSIONS:** SFH measurement continues to be used in many countries on large scale because of its low cost, ease of use and need for little training as the setup for ultrasonographic evaluation is not readily available in rural setups.

KEYWORDS

Abdominal Girth, Dare's Formula, Hadlock's Formula, Johnson's Formula, Symphysio-fundal Height

INTRODUCTION

Assessment of fetal weight is a vital and universal part of antenatal care, not only in the management of labor and delivery but often during the management of high risk pregnancies and growth monitoring. Birth weight of an infant is the single most important determinant of newborn survival. Both low and excessive fetal weights at delivery are associated with an increased risk of newborn complications during labor and puerperium. Limiting the potential complications associated with the birth of both small and excessively large fetuses requires that accurate estimation of fetal weight occurs before decision to deliver is made.

On the other hand, fetal macrosomia is associated with more maternal and fetal complications at the time of birth than other neonatal weight groups. Maternal complications include increased caesarean rate, higher risk of injury to the genital tract, uterine rupture, as well as postpartum hemorrhage. The two main methods for predicting birth weight in current obstetrics are clinical and ultrasonographic methods. In developing countries, ultrasonography may be unavailable or may not be affordable by patients. That is why measurement of fundal height using inexpensive and easily available non-elastic tapes has been recommended as a means of assessing birth weight in low-resource countries.

AIM OF THE STUDY

The present study aimed at estimation of fetal birth weight clinically and sonographically and compare them with actual birth weight after delivery of fetus.

METHODS

The present study was a prospective comparative study done in between in the March 2020 to 31st October 2020 in Department of Obstetrics and Gynaecology, Madhubani Medical College and Hospital, Madhubani, Bihar. The study population consisted of 100 patients which were randomly selected, who were admitted in Obstetrics and Gynaecology Department of MMCH, Madhubani, Bihar.

Inclusion criteria

- Term pregnancies 37-42 weeks
- Singleton pregnancy
- Vertex presentation
- Women should deliver within 3 days of estimation.

Exclusion criteria

- Oligohydramnios, polyhydramnios

- Multiple pregnancies
- Malpresentation
- Congenital abnormalities of foetus
- Intrauterine foetal death
- Premature rupture of membrane
- Pregnancy with uterine fibroid or any abdominal mass
- Placenta previa.

Patients admitted in the Obstetrics and Gynaecology Department of MMCH for various reasons were taken in study after the satisfying the inclusion and exclusion criteria. A preliminary history taking, thorough general examination and obstetric examination were taken for study and informed consent for the study was taken.

Patients were asked to lie flat on their back with thighs slightly flexed after emptying bladder. Symphysio-fundal height and abdominal girth measurement were taken in between contractions with flexible elastic standard measuring tape. Estimated fetal weight was calculated according to Johnson's formula and Dare's formula.

Johnson's formula

Foetal weight in gm = $155 \times (\text{fundal height in cm} - K)$

K = 11 (foetal head at plus station), K = 12 (foetal head at zero station), K = 13 (foetal head at minus station).

Dare's formula

Foetal weight in gm = fundal height in cm $\times$ abdominal girth in cm.

For sonographic method: They were analyzed for estimated fetal weight by Hadlock's formula (inbuilt) on ultrasonography machine.

Patients were followed up till delivery and actual birth weight measured. Their data was taken as per performa.

Statistical analysis

Data obtained was tabulated and analysed using percentages, mean, averages to obtain the percentage errors, average errors of each clinical formula and sonography, after that the mean average error in all cases studied. Standard deviation was calculated using mean. Finally, the correlation coefficient "r" were calculated to know association between actual birth weight and weight decided by clinically and sonographically.

RESULTS

In this study, maximum group of the patients were observed in the 20-25 year age group (60.5%).

Table 1: Maternal age distribution (N=200)

Age (years)	No. of patients	Percentage (%)
18-20	2	1
20-25	60	30
26-30	25	12.5
>30	13	7.5

In this study, out of 100 women 34.5% were primigravida and 65.5% multigravidas.

In this study, 70% of patients delivered vaginally where as 30 % patients had undergone LSCS for various indications.

The cases were distributed as per the birth weight of babies into five groups. In India, average birth weight 2500 – 3000gm. In this study, 2501- 3000gm group had maximum distribution (46.5%) of cases.

The proportion of Low Birth weight (<2500) was found to be high with maternal weight group ranging from 40-55kg (66%).

Table 2: Birth weight in relation to maternal weight.

Maternal weight in kg	Birth weight in gm					Present Study
	<2000	2000-2500	2501-3000	3001-3500	>3500	
40-55	2	14	13	6	1	36(18%)
56-70	0	5	25	12	1	43(21.5%)
>70	0	02	9	6	2	21(10.5%)
Total	2	21	47	25	5	100

Table 3: Birth weight in relation to gravida.

Gravida	Birth weight in gm					Present Study
	<2000	2000-2500	2501-3000	3001-3500	>3500	
1	1(33.3%)	6(28.5%)	17(35.5%)	9(36.7%)	2(0.4%)	34
2	1(33.3%)	8(35.7%)	15(32.2%)	7(30.6%)	2(0.4%)	33
3	1(33.3%)	6(28.6%)	10(22.6%)	6(22.4%)	0	23
4	0	1(7.1%)	3(6.4%)	2(8.2%)	1(0.2%)	8
>4	0	0	2(3.2%)	1(2.0%)	0	02
Total	3	21	47	25	5	100

Table 4: Average error in various fetal weight groups by various methods in present study.

Method	Birth weight in gm					Present Study
	<2000	2000-2500	2501-3000	3001-3500	>3500	
N	2	21	47	25	5	10
Johnson's Formula	488.33	337.52	284.54	215.24	359.20	336.96
Dare's Formula	340.33	198.88	170.65	193.63	204.20	221.53
Hadlock's Formula	252.66	257.92	195.61	203.24	218.80	225.64

The cases within the birth weight (2000-2500gm) were observed more in second gravida (35%) followed by third gravida (28.6%).

Average error = $1/n \sum \{\text{actual birth weight} - \text{estimated birth weight}\}$
Where, n=no of cases, Average error in all groups except <2000gm was least with Dare's formula, closely followed by Hadlock's formula. Average error in <2000gm weight group was least with Hadlock's formula.

Table 5: Maximum error in various fetal weight groups by various methods in present study.

Method	Birth weight in gm					Present Study
	<2000	2000-2500	2501-3000	3001-3500	>3500	
N	3	21	47	25	5	100
Johnson's Formula	790	840	901	732	737	800
Dare's Formula	450	550	566	480	507	510.6
Hadlock's Formula	400	590	517	450	407	472.8

Table 6: Ranges of percentage error in the various methods in present study.

Percentage error	Johnson's Formula	Dare's Formula	Hadlock's Formula
Up to 5%	35.5	50	34
Up to 10%	55.5	68	67
Up to 15%	73	86	87

Up to 20%	80.5	94.5	94
Up to 25%	91.5	98	98

Maximum error was most marked with Johnson's formula and least with Hadlock's formula.

Maximum error with fetal weight 200-2500g was least with Dare's formula. Percentage error of method was calculated by using the formula

$$\text{Percentage error} = x/y \times 100$$

Where x=error in gm, y=actual birth weight in gm,

86% of the cases fell within 15 percentile error of birthweight by both Dare's formula and Hadlock's formula. As compared to that only 73% of cases fell within 15 percentile error of birthweight by Johnson's formula.

Table 7: Standard deviation of prediction error in present study.

Method	±SD
Johnson's Formula	405.04
Dare's Formula	404.68
Hadlock's Formula	400.71

$$\text{Standard deviation} = \sqrt{\sum (x-y)^2/n}$$

Where, x= actual birth weight, y= estimated birth weight.

Standard deviation of the prediction error by different method: 400.71 gm by Hadlock's formula closely followed by Dare's formula followed by Johnson's formula.

Table 8: Comparison of different methods in present study.

Method	Average error	Standard Deviation	Confidence interval
Johnson's Formula	336.96	405.04	280.48 to 393.43
Dare's Formula	221.53	404.68	165.0519 to 278.008
Hadlock's Formula	225.64	400.71	169.7256 to 281.4744

$$\text{Confidence interval} = \text{mean} \pm 2 \text{ SE},$$

Where, SE = $s/\sqrt{n}$, s= standard deviation, n=no of cases

Based on average error in weight, Dare's formula showing near average of actual weight as compared to other formulas. So, Dare's formula is more reliable than other formula. Considering the Degree of variation based on average error, standard deviation and their Confidence interval, Dare's formula and Hadlock's formula are almost comparable. No significant variation has been observed in both the formulas.

DISCUSSION

Both fetal macrosomia and intrauterine growth restriction increase the risk of perinatal morbidity and mortality and of long term neurologic and developmental disorders.

Accurate prediction of fetal weight has been of great interest in obstetrics. As fetal weight cannot be measured directly, it must be estimated from fetal and maternal anatomical characteristics.

For the ultrasonographic method, our results are also consistent with what have been previously observed that the mean absolute percentage error of predicted birthweight varies from 6% to 12% of actual birthweight, and 40–75% of the estimates are within 10% of actual birthweight. The observation that, compared to actual birthweight, ultrasound overestimated low birthweight and underestimated high birthweight, has also been previously reported.

The major finding from this prospective study is that clinical estimation of foetal weight is as accurate as the ultrasonographic method of estimation within the normal birthweight range. Although, while the clinical method overestimated foetal weight, our ultrasonic method underestimated it. However, when there is the case of intrauterine growth restriction (birthweight<2,500 g), both the methods overestimated birthweight, but the ultrasonic method was statistically more accurate with smaller mean errors and more estimates within ±10% of actual birthweight.

Despite the differences in study design, present findings are in consonance with those reported by others that the accuracy of clinical estimation of birthweight is similar if not better than that of ultrasonic estimation. The studies by Hendrix et al. and Raman et al. showed that

clinical estimation was significantly more accurate than sonographic prediction. Similar results as obtained by Sharman et al. and Titapant et al. who observed that ultrasonic estimation was more accurate only when there is low birthweight but in their own studies, both the methods underestimated birthweight by more than 400 g. Watson et al. found no significant difference between the two methods even at extremes of birthweight at term.

Present 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. Even in estimating weight of macrosomicfoetus for making decision regarding trials of labour, there appears to be no benefit in obtaining a routine sonographic birthweight. The role for ultrasonographic estimation appears that, when clinically estimated weight suggests weight less than <2,500 g, subsequent sonographic estimation would yield a better prediction and would be further necessary to assess such foetuses for congenital malformation and to do the biophysical profile to determine the well-being of the foetus.

The potential limitations of the study include: (a) the subjectivity of clinical estimation, (b) use of only one sonographic model to derive estimates of foetal weight, (c) no confirmation that the formula used (Hadlocks 3) is universally applicable.

We regard the overestimation of foetal weight by the clinical method as a positive factor since it will enhance the sensitivity of health workers at peripheral centres if properly taught to them for earlier referral of mothers with macrosomicfoetuses, thus contributing to reduction of obstructed labour and its sequelae.

CONCLUSION

Antenatal fetal weight can be estimated clinically by using Johnson's formula and Dawn's formula and sonographically by Hadlock's formula. Despite the superiority of ultrasonography, the simple clinical method of estimation of fetal weight is of great value especially in a developing country. Thereafter for the confirmation and to rule out complications they can refer to higher centre for ultrasonographic examination and for better management specially when they are high-risk patients. The present study indicates that among full term singleton cephalic presentation, foetal weight estimation using measuring tape is just as accurate as ultrasound estimates for prediction of actual birth weight. This simple clinical method for FEW is easy to perform. It is very useful, inexpensive, and practical tools for predicting birth weight, especially for less experienced examiner and with limited resources.

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