ORIGINAL RESEARCH PAPER

Gynaecology

COMPARATIVE STUDY OF CLINICAL AND ULTRASONOGRAPHICAL ESTIMATION OF FETAL WEIGHT AND ITS CORRELATION WITH ACTUAL BIRTH WEIGHT

KEY WORDS: Birth weight, Clinical method, Fetal weight, Ultrasonography

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ABSTRACT

Introduction- An accurate pre delivery assessment of fetal weight is important in many obstetrical situations.
Aims- The study was conducted at a tertiary care centre for comparison of clinical and ultrasonographical estimation of fetal weight and its correlation with actual birth weight.
Results- Data were collected from 100 term pregnant patients. Clinical as well as ultrasonographical estimates observed to be strongly correlated with actual birth weight. Both the methods are sensitive in birth weight range 2500g-3500g than <2500g and >4000g.Statistical analysis using unpaired "t" test with p value of <0.001 showed that the Johnson's formula correlated well with ultrasonographical estimation of fetal weight.
Conclusion- Clinical estimation of birth weight has a role in the management of labor and delivery. Johnson's formula of clinical fetal weight estimation is simple, easy, cost effective and universally applicable method to predict fetal birth weight which can be used even by paramedics' midwives and at centres lacking ultrasonography facilities.

INTRODUCTION

Estimation of fetal weight prenatally is useful to identify fetus at risk. As Low Birth Weight is closely associated with fetal and perinatal mortality and morbidity, restricted growth and cognitive development and chronic diseases later in life. Low Birth Weight constitutes as 60% to 90% of infant mortality rate. These Low Birth Weight Babies require institutional deliveries for adequate NICU support. In contrast Birth Weight>4kgs babies are prone for shoulder dystocia and for second stage arrest of labour. It further helps in obstetrics decisions making regarding induction of labour, evaluation of feto-pelvic disproportion, mode of delivery, especially iv vaginal birth after caesarean section (VBAC) and detection of IUGR.

Different methods of estimating fetal weight have been tried in different parts of the world in search of the best method. A quick clinical method of fetal weight determination in utero will also be useful to paramedical staff working in rural areas to decide regarding referral to higher centres.

AIMS AND OBJECTIVES

To assess the fetal weight in term pregnancy by the following two methods;
Clinically –Johnson's formula
Ultrasonographically - Hadlock's formula
To compare the above methods with actual fetal weight.

MATERIALS AND METHODS

The study was conducted on 100 women fitting into the inclusion criteria in a tertiary care centre in western Rajasthan after ethical clearance and written informed consent and counselling.

Inclusion Criteria

- All term pregnancies 37-42 weeks
- singleton gestation
- vertex presentation
- Women who had gestation age confirmed by dates and ultrasound scanning before 22 weeks.

Exclusion Criteria

- Abnormal lie and presentation.
- Multiple pregnancies.
- Obvious congenital abnormalities.
- Polyhydramnios or oligohydramnios
- Fibroid or adnexal mass
- Known fetal malformations
- Obesity.
- Intrauterine death

Fetal weight estimation by simplified Johnson's formula

- Mcdonald's measurement for estimation of SFH was done. That is; distance from height of fundus to the upper edge of pubic symphysis
- Station of presenting part was assessed by abdominal examination and per vaginal examination

EFW (gm) = (McDonald's measurement – x) X 155
Where x = 13 when head at minus station
x = 12 when head at zero station
x = 11 when head at plus station

EFW = Estimated Fetal Weight

The most reliable method was measurement in a supine position with an empty bladder, between uterine contractions. The highest point on the fundus was determined by placing a single finger transversely over that point, not necessarily in the midline, and marking this with a pen. The finger was depressed only gently, just enough to determine the upper limit of the uterine fundus. No attempt should be made to correct the fetal lie to be perfectly longitudinal. The measurement is then taken with a non-flexible tape measure from the skin directly above the upper edge of the pubic symphysis to the marked point at the fundal height. Two measurements were ideally be made and the average of these taken was as the SFH.

Then pelvic examination was performed to evaluate cervical dilatation and the degree of descent of the fetal head into the pelvis. The fetus was considered to be at minus station when the lower most portion of the fetal head was above the ischial spine,at zero station(engaged) when the vertex was at the level of the ischial spine and at a plus station when it was below this line.

Fetal weight estimation by Hadlock's formula using USG

- Sonographic estimation was done in all patients with USG machine with 3.5 MHz transducer using standard Hadlock's method as follows-

- After measuring Biparietal Diameter(BPD), Abdominal Circumference (AC) and Femur Length(FL) in cms USG machine calculated fetal weight by formula-
- Log_{10} (EFW) =1.4787-0.003343 x AC x FL + 0.001837 x BPD^2+0.0458 x AC+0.15 x FL
- *BPD measurement* was measured at right angles to the longitudinal axis of the elliptical skull at the level at which a clear midline echo and easily discernible lateral ventricle should be visualized. At this level, the transverse scan also showed cavum septum pellucidum ant thalamus. BPD measured from the outer table of anterior skull to the inner table of posterior skull.
- *Abdominal Circumference (AC)* was measured from a transverse axial image of fetal abdomen at the level of liver. Major landmark was umbilical portion of the portal vein deep in the liver with the fetal stomach representing the second landmark.
- *Femur length (FL)* it is the easiest long bone of fetus to visualize and measure. It was obtained from greater trochanter to the lateral condyle. The head of the femur and the distal femoral epiphysis when present was not be included in measurement.
- The actual birth weight of baby was determined by using electronic weighing machine.
- Ultrasonographic estimation and clinical estimation were done within 7 days from the time of delivery. Both the estimates were documented into a chart.
- Actual birth weight of the babies were recorded and tabulated.
- Statistical analysis was done for above.

RESULTS

In the present study –

Table 1. Distribution of patients according to birth weight

Birth weight (in gms).	No of Cases	Percentage
2001-2500	8	8%
2500-3000	51	51%
3001-3500	32	32%
>3500	9	9%

Table 2. Relation between Maternal age and average baby weight

Maternal Age	No. Of Patients	Avg.Baby Weight
18-25 years	75	3.00kg
26-35years	25	3.05kg

Table No.3 -Average error in various categories by the two methods according to birth weight

Actual Birth Weight (In gms)	2001-2500	25001-3000	3001-3500	>3500
Johnson's	235	154	85	192
Hadlock's	239	73	145	282

Table no. 4 : percentage error in calculating fetal weight by the two formulas

Percentage error	Johnson's	Hadlock's
Upto 5 %	44	34
Upto 10 %	59	63
Upto 15 %	80	82
Upto 20 %	94	94
Upto 25 %	97	98

Percentage error was calculated using = x/y multiplied by 100, where
x=error in gms, y=birth weight in gms.

Table no 5. Standard deviation of predicted error of the two methods:

Method of fetal weight estimation	Standard deviation of predicted error(gms)
Johnson's formula	319
Hadlock's formula	339

Table No 6. Correlation Co-Efficient®

Johnson's formula	0.670	P<0.001
Hadlock's formula	0.600	P<0.001

In the present study, majority of neonates belong to the average birth weight category 2500gms – 3500gms as shown in Table no.1. Maximum number of cases studies was in the age group of 18-25 years as shown in Table no. 2.

The mean average error which is the sum of the positive (overestimation) and the negative (underestimation) from the actual birth weight. Table no. 3 shows that in average weight group (2500-3500gms) in which maximum number of babies are present, clinical birth weight estimation provides similar result as ultrasonographical birth weight estimation. (if clinical method is standardised properly). In our complete study clinical method refers to Johnson's Formula and sonographic method refers to Hadlocks's Formula.

In the present study 80% of the cases are within 15% error limit in estimation of fetal weight by clinical method and ultrasonographic method estimates 82% of cases within 15% of error limit. Maximum number of cases 90-94% lies within 20% error limit. (Table 4).

Standard deviation was calculated using the mean of the error for the two methods. It was found that the least deviation was for the Johnson's formula with 319gms closely followed by the Hadlock's formula with 339gms (table 5)

Correlation analysis of the Johnson's formula and Headlock's formula showed positive correlation with actual birth weight. In our study (Table 6), Johnson's formula (r- 0.670) showed better correlation compared to Hadlock's formula(r – 0.600).

DISCUSSION

In our study average error in weight group 2500gms to 3500gms in which (maximum babies are present) Johnson's formula is 239gms while for ultrasound it is 218gms. (For baby weight group, 2500-3500gms). (Table 3) In similar study of Amritha A Bhandary *et al.*[1] found average error for Johnson's formula was 292.5gms and for Hadlock's formula was 299.1gms. In a study by Bajracharya J *et al.* [2] found an average error of 290gms in fetal weight estimation by Johnson's formula. Kishore P Chauhan *et al.* [3] found an average error of 294gms by Johnson's formula and 300gms by Hadlock's formula. In sharp contrast to the above observations, Shamley *et al* [4], comparing the clinical and ultrasonographical method, noted that error of clinical estimate to be significantly higher than that for ultrasonographic estimate. The difference from our results may be attributed to the standardized method that was used for clinical estimation in our study.

In the present study of fetal weight estimation, clinical method estimates 80% of cases within 15% of error and ultrasonographic method estimates 82% of cases within 15% of error (table 4). Amritha A.Bhandary *et al.* [1] found 63.5% of population within 15% of error by clinical and 85.5% of cases within 15% error by ultrasonographic estimates. In study by Kishore P Chauhan *et al.*[3], clinical estimates to be within 63.5% for 15% of error and 85.5% cases within 15% of error by Hadlock's. For the ultrasonographical method, our results are consistent with the study of Nahum G *et al.* [5] who showed that 40-75% of the estimates are within 10% of actual birth weight. In the present study, 63% estimates are within 10% of actual birth weight by Hadlock's formula. For other studies.75% of the estimates are within 10% of the actual weight. Harlev A *et al.* [6] ,Akionala SS.[7]

In the largest study comparing ultrasound verses clinical EFW, Chauhan *et al.*[8] did not find significant difference in 460 patients at gestation ages of between 37-40weeks while clinical estimates were correct within 10% error in 61.7%

their cases, ultrasound estimates were correct in 60% of cases.

Standard deviation of prediction error for clinical estimation was 319 and for ultrasonography it was 339(table 5). Tiwari and Sood[9] got standard deviation of 338.75 and 203.20 for clinical and ultrasonographical estimates respectively. In a study by Amritha A Bhandary *et al.* [1], standard deviation was 309 for clinical estimate and for ultrasonographical estimate it was 258.48.In comparative study by Anupama Kumari *et al.* [10], standard deviation was 262.2 and 166.5 for clinical and sonographic estimates respectively. Kishore P Chauhan *et al.* [3] standard deviation was 302 and 260 for clinical and sonographical estimates.

Correlation coefficient of present study, for clinical estimation was 0.670 and for ultrasonographical study was 0.600 (table 6). Correlation coefficient of clinical estimation was 0.780 and for ultrasonographical estimation was 0.740 in a study by Akionola S.S.*et al*.[7].Dare *et al.[*11] found correlation coefficient for clinical estimate to be 0.74.

Dudley NJ [12] says the accuracy of EFW is compromised by large intra- and inter observer variability. Pergine E *et al*. [13] says although, in general, clinical estimates of birth weight perform favourably compared with ultrasonographic estimates, ultrasound immediately prior to labour is more accurate at predicting the low- or high-birth-weight fetus. A study by Chen P *et al* [14] shows to improve the weight estimation accuracy for low or excessive weight fetus. Separate formulas are necessary.

CONCLUSION

Thus our study implies that clinical estimation of fetal weight by Johnson's Formula is sufficient in estimating the actual birth weight. The same can be used in the management of labor and delivery in term pregnancy. Our conclusion is further supported by similar studies. Johnson's clinical formula can be of great value in a developing country like ours, where ultrasound is not available at many healthcare delivery systems. It is easy, cost effective and simple and can be used even by midwives. Further studies are however necessary to improve the accuracy of fetal weight and to determine if estimation of fetal weight prediction near delivery actually improves outcome and how applicable these methods can be to situation that alter birth weight such as premature rupture of membranes and obesity that were excluded in the present study.

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