Comparative Study of Various Methods of Fetal Weight Estimation at Term Pregnancy

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Research Article

Abstract: Objective: To assess and compare the accuracy of clinical and sonographic fetal weight estimation in predicting birth weight at term pregnancy, patients who were in latent or in active phase of labour. Design: prospective cross sectional study involving 500 full term, singleton pregnancies with cephalic presentation. The study was conducted in a tertiary care centre at karad, Maharashtra, India. **Method:** In a prospective study of 500 women, fetal weight was estimated by both clinical formulas (insler and Johnson formula). An ultrasonography was then performed by sonologist to estimate the fetal parameters (AC AND FL).The fetal weight was calculated by using standard Hadlock table (Hadlock formula using AC and FL), Expected baby weight according to clinical formula and sonography was compared with actual birth weight after delivery. Accuracy of estimates was assessed in terms of percentage and grams. The chi-square test was used for comparison. **Results:** The means percentage of error was 248.2 Gms and 13.48 percentages for insler EFW,265.2 Gms and 14.36 percentages for Hadlock EFW, 573 gms and 31 percentages for Johnson formula. The proportion of the EFW which were within 10 percentage of birth weight was 66.6 percentage for insler formula, 70 percentage for Hadlock formula and 22.4 percentage for Johnson formula. Insler and Hadlock EFW were correlated well with actual birth weight, as compare to Johnson formula that had a highest error in prediction of birth weight. **Conclusion:** fetal weight estimation using measuring tape (insler formula EFW) is just as accurate as ultra sound estimates (HADLOCK FORMULA BY USING AC AND FL) for prediction of birth weight. The present study indicates that, among full term singleton cephalic pregnancies, fetal weight estimation using measuring tape is just as accurate as ultra sound estimates for prediction of actual birth weight. This simple clinical method for fetal weight estimation is easy to perform and teach. This is an inexpensive and practical tool for predicting birth weight, especially for less experienced examiner.
Key words: estimated fetal weight, actual birth-weight, abdominal circumference, femoral length, ultrasonography, clinical formula.

Introduction

Birth weight is the greatest single factor in the survival of fetus is an important factor of neonatal problems. Accurate estimation of fetal weight is one of the important aspects in management of labour. Fetal weight is also important in assessing whether the fetus is small for gestational age or large for gestational age in order to have a good obstetrical decision making and also to avoid intrapartum distress and birth trauma and thereby to reduce neonatal morbidity and mortality. Estimation of fetal weight predelivery helps to decide mode of delivery and anticipate problems during labour as well as anticipate possible shoulder dystocia. During the last four decades there has been a marked reduction in the perinatal deaths (10 per 1000 births in developed countries).Even though the perinatal death in developing countries like India remains high (60 per 1000 births). Perinatal mortality rate can be reduced by early antenatal registration and regular antenatal visits .The estimation of fetal weight before delivery is of paramount importance considering the hazards of low birth weight and macrosomia. Until the early 1980, fetal weight estimation relied exclusively on clinical methods based on abdominal and uterine measurements.[1]

Methods

This prospective cross sectional study was conducted on 500 pregnant women with single foetus in cephalic presentation who were admitted to Krishna hospital, karad, Maharashtra, India. This study includes booked, unbooked and referred cases. These women were from all socio economic groups' .Detailed history and period of gestation were noted in the proforma. General physical examination, abdominal examination and per vaginal examination was carried out.

Exclusion Criteria
1. Multiple pregnancy
2. Pregnancy with fibroid or ovarian tumour or cyst
3. Poly/oligohydramnions
4. Malpresentation
5. Ruptured membrane
6. Intrauterine death

all other parturient were included irrespective of maternal age , gestational age , parity , maternal weight , height ,head descent , routes of delivery , and presence of pregnancy complication other than the once on exclusion criteria
fetal weight was measured in utero at full term pregnancy by three formulas
1. Insler and bernsteins formula
2. Hadlock formula(by using AC and Fl)

3. Johnson formula

Fetal weight was estimated by using these 3 formulas at full term pregnancy and noted in the proforma. After delivery actual birth weight was measured in grams and correlated with actual birth weight. Weight of all the new born was taken in single weighing scale.Analysis of the difference between calculated EFW and actual birth weight was done. The relative observations were recorded.

1) Insler and Bernstein Formula -Weight in GMS = SFH (in CMS).AG (in CMS)[3]

-After emptying the bladder patient placed in supine position with legs flat on the bed , extended both at hips and knee .After correction of dextrorotation, measurement from height of fundus to the upper edge of symphysis pubis was taken in cms by measuring tape .upper hand was placed firmly against the top of the fundus. Reading was taken from perpendicular intersection from the fundus to pubic symphysis during uterine relaxation.[1,5]

-This was followed by measurement of abdominal girth in cms at the level of umbilicus during uterine relaxation. For AG measurement, the tape was repositioned to encircle the woman's waist, at the level of umbilicus, without applying excessive pressure to tighten the tape around the abdomen. [1,2]

2) Hadlock Formula -LOG10 EFW =1.304+0.05281 AC +0.1938 FL -0.004. AC.FL[5]

-Sonographic estimation was done that included electronic caliper measurement of fetal head, abdominal and femur as well as amniotic fluid, presentation and placental evaluation in all patients with usg machine at Krishna hospital, karad after completed 37 weeks of gestation. The ultrasound FW was estimated by using 2*2 nomogram tables[5](standard Hadlock reference table) that use two biometric parameters to provide an estimated fetal weight(AC AND FL)[5].Biometry of the fetus was taken using the following parameter - abdominal circumference (AC) and femur length (FL)

3) Johnson Formula (1957) Weight in grams = (SFH-X).155

WHERE X=13 when pp at minus station

X=12 when pp at 0 station

X=11when pp at plus station

-SFH was measured similarly as in insler formula then pelvic examination was done to evaluate the degree of descent of the head into the pelvis. The fetus was considered to be at minus station when the lowermost portion of the fetal head was above the ischial spine, at zero station (engaged) when vertex was at the level of spine and at a plus station when it was below this level. Single measurement (SFH) and information on the fetal station were recorded on proforma and later used to calculate the fetal weight according to the formula proposed by Johnson.[2,1]

RESULTS: The mean age of the patients included was 26.5+/- 8.5 years. Out of 500 women, 59 percentage women were primigravida and 41 percentages were multigravida. The mean maternal weight was 64+/-25 kg. The mean maternal height was 164+/-20 cms. There was no association noted between ages, parity, height, weight. Out of 500 cases 59% patients were primigravida whereas 41% patients were multigravida.

Table 1: Distribution of Cases According to Birth Weight

WEIGHT IN KGS	Cases	Percentage
< 2 KGS	06	1.2
2 – 2.5 KGS	116	23.2
2.6 – 3 KGS	257	51.4
3.1 – 3.5 KGS	103	20.6
> 3.5 KGS	18	3.6

In the study done birth weight of the newborn ranged from minimum being 1525 gm to 4552 gm maximum being in the range of 2600 to 3000 gm .in study revealed that the cases were distributed as per the birth weight of the babies into 5 groups . 122(24.4 percentage)neonates birth weight less than 2500 gms,257(51.4 percentage)neonates birth weight between 2.6-3 kgs,103 neonates (20.6 percentage) birth weight between 3.1-3.5 kgs ,and 18 (3.6 percentage) neonates birth weight more than 3.5 kgs.

Table 2: Average Error in Various Fetal Weight Groups by 3 Formula

True Birth Weight(KG)	<2	2-2.5	2.6-3	3.1-3.5	>3.5	All Cases
I & B Formula(Average Error in GMS)	-396.16	-288.54	-212.1	+137.48	+208.27	-248.2
I&B Formula(Average Error in Percentage)	-21.4	-15.7	-11.6	+7.5	+11.2	-13.48
Hadlock for.(average error in grams)	-556.5	-324.5	-97.86	+143.29	+206.72	-265.2
Hadlock for(average error in percentage)	-30.04	-17.5	-5.3	+7.8	+11.2	-14.36
Johnson for(average error in gms)	+1184	+832	+519.30	+202.5	+131.16	+573
Johnson for(average error in percentage)	+64.33	+45	+28	+11	+7.1	+31.0

The mean average error represents the sum of the positive (overestimation) and the negative (underestimation) from actual birth weight. Johnson formula EFW had highest average error in all weight groups except >3.5 kg weight groups, where error was 131.5 grams, less than Insler and Hadlock formula. Average error was least in the Hadlock EFW in 2.6-3 kg weight groups where error was only 97 Gms (5.3percentage). In other weight groups it was on the higher side than I&B EFWs (clinical formula). I & B EFW and Hadlock EFW were more comparable with actual birth weight than Johnson EFW. In most of the cases, I & B EFW and Hadlock EFW correlated well with actual birth weight. Our study showed that fetal ultrasound using hadlock's formula(by using ultrasound) had error in estimation of fetal weight by about 265 gms and 70 percent estimates were within 10 percentage of actual birth weight, I&B formula(clinical formula) had error in estimation of fetal weight by about 248 gms and 66 percentage estimates were within 10 percentage of actual birth weight , on the other side with Johnson formula(clinical formula) had error in estimation of fetal weight by about 573 gms and only 22 percent estimates were within 10 percentage of actual birth weight.

Table 3: Distribution of Cases According to Error in GMS

	I&B	Hadlock	Johnson
<100gm	135	110	35
100-199 gm	119	117	40
200-299 gm	99	91	34
300-399 gm	68	65	69
400-499 gm	37	57	57
500 gm or more	42	60	265
total	500	500	500

Difference between actual birth weight and estimate birth weight were calculated, statistical analysis using chi-square test with p value of <0.0001 showed that its significant.

Table 4: Error in percentage

	I&B	Hadlock	Johnson
<10%	333	350	112
10-20%	132	108	169
21-30%	24	25	104
>30%	11	17	115
total	500	500	500

Table 5: Statistical analysis using chi-square test with p value of <0.0001 showed that it s significant

	I & B	HADLOCK	JOHNSON
<500 GMS ERROR	91.6	88	47
<10 PERCENTAGE	66.6	70	22.4

table showing that 91 percentage of cases with I & b formula 92 percentage of cases with Hadlock formula and 47 percentage of cases with Johnson formula had shown <500 gms error with actual birth weight .66.6 percentage clinical estimates by i&b formula and 70 percentage estimates with Hadlock formula were within 10 percentage of actual birth weight. With Johnson formula only 22 percentage clinical estimates were within 10 percentage of actual birth weight. DISCUSSION-Fetal weight estimation using measuring tape and insler formula was as accurate as ultrasound estimates with Hadlock formula (AC AND FL) using for predicting birth weight. In their original publication in 1954 Johnson and Toshach reported that estimated fetal weight was within 353 grams of the actual birth weight in 68% of their 200 cases. In the present study using the same formula only 38% cases were within 350 grams of the actual birth weight.in 1990 Dare FO performed study[2] on 498 patients by using product of Symphysio fundal height and abdominal girth at the level of the umbilicus. EFWs correlated well with actual birth weight; in the present study using same formula average error was 13.4% which was correlated well with actual birth weight.In practice, both insler and Johnson method were easy to perform and teach.dr.mario et at 2008,sao Paulo hospital, brazil published a comparative study between clinical formulas and ultrasound in predicting the fetal weight .all pregnant women admitted to the labour ward at full term pregnancy(completed 37 weeks),with live single tone fetus in cephalic presentation and intact membrane were eligible . no significant differences in the percentage of estimates within 10 percentage among 3 methods were detected by using chi-square analysis(p>0.05) .in their study mean error was found least with ultrasound efw (312 gms) and the percent of ultra sound prediction within 10 percentage of the actual birth weight obtained in the study was 65 percentage .with insler formula mean was around 436 gms and 61 percentage estimates were within 10 percentage of birth weight .with Johnson formula error was 335 gms and 57percentage cases had shown <10 percentage of error with actual birth weight. in our studies significant difference was found as shown in table 8 and 9.estimated error was higher with Johnson formula (573 gms) and 22.4 percent of cases had shown <10 percentage of error with actual birth weight.efw by Johnson formula was not correlated well with actual birth weight, but i &b EFWs and Hadlock EFWs was correlated well with actual birth weight.

Conclusion

The present study indicates that, among full term singleton cephalic pregnancies, fetal weight estimation using measuring tape is just as accurate as ultra sound estimates for prediction of actual birth weight. This simple clinical method for FWE is easy to perform and teach and may useful, inexpensive and practical tools for predicting birth weight, especially for less experienced examiner.

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