Original Article

Accuracy of Estimated Fetal Weight by Clinical Assessment and Ultrasonography

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ABSTRACT

Objective: To compare accuracy of estimating fetal weight of term fetus by clinical assessment and Ultrasonography.

Study Design: Comparative Clinical Trial Study.

Place and Duration of Study: This study was conducted in obstetrics and gynecology unit of Hayat Abad Medical Complex.

Materials and Methods: - This study was carried out on 300 subjects, with full term; normal pregnancy. Patients had fetal weight estimation by two approaches

1) Clinical assessment done by Leopold's maneuvers and symphysio fundal height in centi-meters and
2) Sonographic measurement by using Toshiba capacee with curvilinear transducer of 3.5 MHz.

Birth weight at delivery was used on gold standard.

The accuracy of these two methods of estimating fetal weight was compared using student t test, and $\varkappa^2$ P> .05 was considered significant.

Result: Out of 300 cases, 292 cases were compared both. Ultrasonically and by clinical assessment .while 8 babies could not be picked up of ultrasonically because of fetal weight more than 4.0 KG , out of 292 cases (218) 72.7% were assessed. Correctly by clinical assessment while (224) 74.7% were assessed .correctly by ultrasonography.

Conclusion: - Clinical assessment is equally accurate as ultrasonography in normal term birth weight estimation.

Key Words: Fetal Weight, Ultrasonography, Clinical Assessment, Biparietal diameter, abdominal circumference.

INTRODUCTION

Accurate estimated fetal weight is of paramount importance in the management of labour and delivery. Ultrasonic methods of evaluating the fetus are now employed widely for many reasons.

The two main methods for predicating birth weight in current obstetrics practice are

1) Clinical techniques based on abdominal palpation of fetal parts and fundal size.
2) Sonographic measurements of selected fetal parts, which are then inserted into the regression equations to derive the EFW.

The former is composed of fundal height, size of fetal head and body amniotic fluid volume. Clinical and ultrasound estimation of fetal weight have recently been used in many centers. The advantages of clinical estimation are easy and quick without any instruments. However there is no standard method. The experience of clinician is very important .By ultrasound estimation, the anomaly scan can be performed at the same time but ultrasonography is costly and a well trained Ultrasonographer is needed. Several investigators have suggested that palpating the uterus to estimate fetal weight is in accurate .it generally is accepted that the objectivity and reproductivity of sonographic measurement yield more accurate estimates than clinical assessment of birth weight, but only a few studies have compared both methods[1] (Colman et al, 2006).

Several formulas that use, multiple ultrasonic, parameters, are used to estimate fetal weight .The most widely used formula in that of [2]Shepard et al ,1982 in which estimated fetal weight is derived from BPD and Ac.This equation predicts fetal weight with an accuracy of 15% to 20%.[3,4] Hadlock et al(1985), Warsof et al(1977) also have introduced equations to estimate fetal weight using combinations of BPD (Biparietal diameter) Ac (Abdominal circumference) and FL(Femur length) it may be in accurate if there is dolicocephalic or braclycephalic head.

In an effort to increase the accuracy of ultrasonic estimation of fetal weight,[3] Hadlock et al (1985) advocate the use of HC, AC and FL measurements in combination. They have shown that the prediction of fetal weight has a standard deviation of $\pm$ 15(2 standard deviation).

However the accuracy in predication of fetal weight decrease in small fetuses (less than 1500gm) and the error approaches $\pm$ 20%.

MATERIALS AND METHODS

This study was conducted in obstetrics and gynecology unit of Hayat Abad Medical Complex. The cases were included on the basis of strict inclusion criteria . In all cases ultrasound estimated fetal weight and clinical assessment for fetal weight was obtained on the day of patients admission for labour related reasons , and delivered within 48-72 hours .Additionally cases were excluded in which fetal head was embedded in the

pelvis because of the well documented reduced accuracy of biparietal diameter measurement made on such heads .Individual ultrasound estimated fetal weight were calculated by the formula of Hadlock. All clinical assessment was made by Leopold's maneuvers and measuring symphsio fundal height in (cm) by senior trained medical officers. Imaging studies were carried out by using Toshiba Capacee with a 3.5 Mhz Curvilinear probe.

300 cases were included in this study and it was convenience sampling (not probability).

The inclusion criteria was all term patients with period of gestation 37th to 41weeks singleton pregnancies who delivered alive fetus , with intact membranes at time of ultrasongraphic estimation and clinical assessment , exclusion criteria were all high risk pregnancies, Intrauterine growth retardation , multiple pregnancies and all those who were unsure of dates.

RESULT

This study included 300 cases who met the inclusion criteria as all term patients with period of gestation 37th to 41 weeks singleton pregnancies who delivered alive fetus with intact membrane at time of ultrasonographic estimation and clinical assessment 24.3% of patients were primi para, 52.6 % patients were multi Para and 23.0 % of patients were grand multi Para.

Table No.1:Clinical and ultrasonographic estimation of fetal weight.

Author	Method	Accuracy
Watson[7]	Clinical examination	7.7 % mean error
Loeffler[10]	Clinical examination	Within 1 pound in 80 % of estimate
Shepard[11]	Ultrasound (BPD, AC)	Within 10% in 51 % of estimation
Hadlock[6]	Ultrasound HC, AC , FL)	7.5 error =1s
Warsof	Ultrasound (AC, FL)	10.9% mean error

Table No.:2 Percentage of normal term birth weight

Weight /gm	n	% age
≤2500	32	10.6
≤3000	63	21
≤3500	106	35.3
≤4000	94	31.3
≤4500	5	1.6

Majority of patients 69.0 % belonged to middle class and only 3.3% belonged to high class . 21.3 % of patients had 37 weeks period of gestation 23.0 % had 38weeks, 18% had 39weeks, 23.0 % had 40weeks and only 14.3 % of patients had 41 weeks period of gestation.

Regarding mode of delivery 76.0 % has spontaneous vaginal delivery 10.3% had instrumental delivery , 13.7 % had caesarean delivery , 11% of babies were born with poor APGAR score at birth , 9% of babies had satisfactory.APGAR score while majority of babies 80 % were born with good APGAR score.

Table No.3: Accuracy of birth weight estimation by clinical assessment and ultrasonographic assessment

	By clinical assessment		By ultrasonographic assessment	
Degree of accuracy	n = 300			
Accurate estimation	218	72.7%	224	74.7%
Over estimation	45	15.0%	45	15.0 %
Under estimation	37	12.3 %	23	07.7%

In these babies 56.7 % were males and 43.3 % were female.

The actual birth weights of babies were between 2300gm uptil 4500gm.

The degree of accuracy of estimation of fetal weight by clinical assessment and ultrasonographic assessment are. Shown in table-3

Eight cases were not estimated ultrasonographically because the ultrasound machine was not calibrated for it.

Mean weight by clinical assessment is 3271.91gm while mean weight by ultrasound estimation is 3258.21gm.

On the basis of sample data, we conclude that there is no significant difference between both techniques (P value 0.206>0.05).

The advantage of using ultrasound for EFW has been questioned .Bawm et al(2002) concluded that ultrasound offered no advantage over clinical estimates of fetal weight at term, An EFW should be recorded in the assessment of all patients who are at term and again when they are in labour, with full awareness of the limitation of the methods for making such estimation[5].

DISCUSSION

Accurate estimation of fetal weight is of paramount importance in the management of labour and delivery .During the last decade, EFW has been incorporated into the standard routine ante partum evaluation of high risk pregnancies and deliveries .

The accuracy of predicting birth weight by a variety of different formulas incorporating different ultrasonic measurement has been studied extensively. However, no particular formula or biometric measurement has superior quality.

The basic characteristic of 300 women included in our study were parity of women, socio economic status, period of gestation although all the three above

characteristic does not directly affect the weight of baby, but socioeconomic status, a well as the parity of women effect weight of baby . In this study 69.0% of patients belonged to poor socioeconomic class, as a consequence about 8.3% of babies weight less than 2500gm although term babies.

According to William's obstetrics (2001), the principal determinants of fetal growth rate in pregnancy are related in large part to factors influenced by the socioeconomic status of mother, such as diet, smoking or substances abuse.

In general the greater the socioeconomic deprivation, the slower the rate of fetal growth rate in pregnancy.

In this study none of the patients were smoker or addict, Term infants, however frequently weight less than 3200 gm and some time as little as 2250gm or even less, In this study 5.3% of fetus although term weighted <2500gm as in table-2 although mothers were sure of their dates, but no record of serial ultrasound or other diagnostic procedures were available to lable them as IUGR, but by ponderal index[6] (Reece EA and Hobbins JC, 1995) they were not IUGR, 10.6% of small for gestational age ,infants identified by birth weight percentiles are not growth retarded by their ponderal index.

$$\text{Ponderal index} = \frac{\text{Birth weigh (gm)} \times 100}{\text{Crown heal length (c.m)}^3}.$$

Regarding POG, this study included term pregnancies (37-41weeks) but during the second half of pregnancy the fetal weight increases in a linear manner with time until about 37weeks of gestation and then the rate slows hence after 37weeks of gestation, POG does not have marked effect on fetal weight[7] (William, 2001)

The fetal basic characteristics included mode of delivery, sex of the baby, APGAR score of baby at birth and actual weight of baby.

In this study majority of babies (76.0%) were born by spontaneous vaginal delivery and majority of babies 81.0% were born with good APGAR score. Since most of deliveries were normal with male babies 56.7% and female 43.3%, the boys weigh about 100gm heavier than girls (William, 2001) but in this study this factor is not considered.

In a study conducted by Suneet et al(1998) at the department of obstetrics and Gynecology, Medical college of Geargia, Augusta in which patients in early labour had fetal weight estimation by two approaches[8].

1) Clinical evaluation and palpation followed by.
2) Sonographic menesuration of fetal diparietal diameter, abdominal circumference and femur length applied to Hadlock's formula.

The accuracy of these two methods of estimating fetal weight was composed using t test, welcoxon test and χ^2 test P<.05 was considered significant[8] (Suneet et al 1998), it was found that sonographic EFW was more accurate then clinical EFW in preterm but not in term or post term pregnancies, similarly in our study with p.value 0.206 and P> 0.05 considered significantly, it was calculated that there was no significant difference between both techniques for term fetuses as in table-3

In the study of Shamley K T and Landon MB 1994[5] 70-79% of birth weight predication were within 10% of actual birth weight and 79—91% were within 400gm by ultarsonography[9]. For clinical estimation of weight 66% were within 10% of actual birth weight and 77% within 400gm

The formula with greatest accuracy and clinical use was Hadlock equation using four parameter of BPD, HC and AC (Hadlock et al ,1985). [3]

Log 10 EFW =1.3596+0.00064(HC) =0.024(AC) + 0.174(FL) +0.0061(BPD) (AC) - 0.00386(AC) (FL).

Hence in our study, the equation to determines fetal weight was that of Hadlock et al (1985)[3] in which ultrasonic prediction of fetal weight gave 74.7% accuracy (table-3) .

In our study as in table 5, shows degree of accuracy by clinical assessment as 72.7% with under estimation 15.0% and our estimation 7.7%, the results being comparable with the study conducted by Shermon et al (1998) [10], conducted at the department of obstetrics and Gynecology, Asraf 2010 – Harafeh Medical center Zeriyin , Israel as in this study in the middle range of birth weight (2500 - 4000gm) [11].

The clinical estimation had no systemic error, the accuracy was 69% and the ultrasonic method under estimated the actual weight by 9.2% while accuracy was 72% .In the high birth weight group (greater than 4000gm) both methods under estimated systematically the actual birth weight, but mean errors were not significantly different.

In a study conducted by Watson et al (1998) the fetal weight was calculated by the formula of Shepard and coworkers[12].

In this all estimations were made with in 48hrs of delivery.

The mean error in clinically estimated weight was 277gm while that in the ultrasound calculated weight was 286gm.

In a study conducted by Noumi G et al (2005) even when performed during labour by residents ,which consisted of achieving clinical followed by sonographic EFW by the admitting resident during active phase of labour .The results of this study showed that clinical EFW was correct (within ±10%) in 72% of cases and sonographic EFW was correct in 74% of the cases[13]. However the sensitivity of predicting birth weight of 4 k.g or more was only 50% both clinical and sonographic EFW with 95% and 97% specificity respectively.

In our study more than 4000gm of fetuses could not be compared ultrasonically because the ultrasound machine in our unit was not calibrated for fetuses with

weight greater than 4000gm there were 8 such cases weighted more than 4000gm . Hence they were estimated only clinically although total number of cases were 300, 292 cases were compared both ultrasonically and by clinical estimation. This problem has also been quoted by Shamley and Landon (1994) in his study as their sensitivity of 62% confirms Had lock observation about limited ability of sonographic equation to identify the macrosomic fetuses[9] .Conversely specificity for predicting birth weight under 3800 gm was good.

In a study done by Ashrafganjoog et al 2010 the sensitivity values of predicting birth weight for ultrasound, clinical and maternal EFW were 17.6%, 11.8% and 6.3% with specificity of 93.5% , 99.6% and 98.0% respectively, the conclusion drawn in above mentioned study were that EFW by ultrasound offers no advantage over clinical assessment when performed during pregnancy or labour.

CONCLUSION

Our data indicate that clinical examination may be as accurate as ultrasound determination in estimating the weight of term fetuses, both methods have as approximate of 25 % error. It is not surprising that clinical estimation is no different from ultrasound estimation for average sized fetus. In term fetuses of <3000 gm and >4000, Ultrasound estimation was not superior to clinical estimation.

One advantage of ultrasound in this setting, however, may be in eliminating a significant variation between observers.

In the term fetus, the estimation of fetal weight with Leopold's maneuvers is still useful clinically.

REFERENCES

1. Colman A, Maharaj D, Hutton J. Reliability of ultrasound estimation of fetal weight in term single ton pregnancies. NZ Med J 2006;119:2146-2150.
2. Shepard MJ, Richards VA, Berkowitz RL. An evaluation of two equations for predicting fetal weight by ultrasound. Am J Obstet Gynecol 1982; 47: 142-146.
3. Hadlock FP, Harrist RB, Sharmann RS, Deter RI, Park SK. Estimation of fetal weight with the use of head, body and femur measurements: a prospective study. Am J Obstet Gynecol 1985; 151:333-337.
4. Warsof Sl, Gohari P, Berkowitz R. The estimation of fetal weight by computer assisted analysis. Am J Obstet Gynecol 1977; 128:881-889.
5. Baum JD, Gussman D, Wirth JC. Clinical and patient estimation of fetal weight vs ultrasound estimation. J Reprod Med 2002; 47: 194-198.
6. Ree EA, Hagay Z, editors. Prenatal diagnosis of deviant fetal growth. Medicine of the fetus and mother. 2nd ed. New yark:Lippincott-Raven;1995. p.709-720.
7. Cunnigham FG, Gant NF, Leven KJ, editors. William osttetrics: ultrasound and Doppler. 21st ed. New yark: Mc Graw Hill; 2001.p.1093-1116.
8. Suneet P, Nancy W, hendrise, Everett F, Magann. Limitations of clinical and sonographic estimates of birth weight. Obstet Gynecol 1998; 91: 72-77.
9. Shamley KT, Landon MB. Accuracy and modifying factors for ultrosonographic determination of fetal weight at term. Obstet Gynecol 1994;84:926-930.
10. Sherman Dj, Arieli S, toubin J, Siegel G, Caspi E, Bukovsky I. A comparison of clinical and ultrasonic estimation of fetal weight. Obstet Gynecol 1998: 212-217.
11. Ashrafganjooei T, Naderi T, Eshrati B, Babapoor N. Accuracy of ultrasound clinical and maternal estimates of birth weight in term women. Estern Mediterranean Health J 2010;16:313-317.
12. Watson WJ, Sisson Ap, Harlass FE. Estimated weight of the term fetus. J Reprod Med 1998;33: 369-37.
13. Noumi G, Callado KF, Bombard A. Clinical and sonographic estimation of fetal weight performed during labor by residents. Am J Obstet Gynecol 2005;195:1407-1409.

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