

Role of Ultrasound in Foetal Weight Assessment: A Hospital Based Study

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ABSTRACT

Aim: To assess the validity of ultrasound scanning in predicting fetal weight.

Methods: This comparative cross-sectional study was carried out at Combined Military Hospital, Quetta from December 2007 to May 2008. Fifty cases were included in study fulfilling the inclusion and exclusion criteria. Gynecologist referred patients to radiology department. Fifty Patients fulfilling inclusion criteria were assessed in radiology department. Single Sonologist took measurements which were biparietal diameter, femur length and abdominal circumference. Hadlock et al III formula was used for fetal weight estimation. Actual fetal weight was taken after delivery, up to 24 hours and compared with the estimated fetal weight.

Results: This was a cross sectional comparative study. Fifty cases were included in study fulfilling the inclusion and exclusion criteria. The result showed that mean of actual fetal weight was 2913 ± 343.78 . Mean of estimated fetal weight was 2083 ± 196.29 . Paired sample T test was applied (P 0.000). Standard error of difference between two means were also calculated which was 55.98. This difference of standard error was not even equal to the actual difference between the two means, So the difference of estimated fetal weight and actual fetal weight was statistically insignificant.

Conclusion: Ultrasound estimated fetal weight is not accurate and there is statistically insignificant difference between Actual and estimated fetal weight, which means that ultrasound estimated fetal weight is not accurate and ultrasound measured fetal weight should not be used as a gold standard while considering the management of macrocosmic or low birth weight fetus.

Keywords: Estimated fetal weight, actual fetal weight, ultrasound

INTRODUCTION

Fetal weight estimation is common obstetrical practice at the present time^{1,2}. It guides clinicians to finalize important obstetrical decision. Perinatal mortality rate is much higher in Pakistan as compared to developed countries². Perinatal mortality is closely associated with the weight of the fetus. Although there are many other factors, which are also related to it. Fetal macrosomia is also a common condition in diabetic mothers, which leads to different obstetrical problems³. Fetal and neonatal morbidity, such as shoulder dystocia, is significantly increased in the larger fetus⁴. There is also increased risk for the intrauterine growth restricted (IUGR) fetus. Accuracy of fetal weight estimation is higher if several ultrasonic fetal parameters are measured, because the total body mass of fetus depends upon the size of fetal head, abdominal circumference and femur length⁵.

The formulae currently used to estimate fetal weight use the fetal biparietal diameter (BPD), head

circumference (HC), chest circumference (CC), abdominal circumference (AC), and femur length (FL) in different combinations. Investigators used ultrasound measurements and take birth weight within days of delivery to establish their models for estimating birth weight. So aim of study is to demonstrate that the combination of fetal parameters provides the most accurate fetal weight in utero of our population, which is confirmed later on by weighing fetus after delivery.

PATIENTS AND METHODS

All patients referred by Gynecologist to radiology department which were having single pregnancy and of 38 weeks of gestation. All pregnant patients were healthy having single pregnancy of 38 weeks measured on ultrasound. Any patient with twin pregnancies or multiple pregnancies or who had any systemic disease like diabetes and any complication of pregnancy like Chromosomal or significant structural anomalies were excluded. After consent the participants were explained about the procedure and were asked to evacuate the urinary bladder before the scanning. The USG measurements of the fetal BPD, AC and FL were obtained with the commercially available real time

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ultrasound (aloka SSD -5500) equipped with a 3.5 and 5 MHZ convex transducer. The fetal biometric measurements were taken with the screen calipers. The BPD, AC and FL were measured in centimeters. The fetal weight estimation was done by using the formula proposed by Hadlock et al III using the different parameters like BPD, FL and AC. BPD was measured as the largest diameter between the outer and inner tables of the fetal skull. Measurement was done at standard transverse axial plane passing through the widest portion of the skull with both the thalami and Cavum septum pellucidum in mid line. Abdominal Circumference (AC) measurement was obtained in the transverse plane perpendicular to the long axis of the fetal aorta or spine at the Porto-umbilical vein complex within the liver. Femur length was measured as the linear distance between the greater trochanter of the femur to the distal metaphysis. Femoral epiphysis should not be included in the measurement. Hadlock et al formula was used for fetal weight estimation, which is mentioned below.

$$\text{Log}_{10} \text{ BW} = 1.335 - 0.0034 (\text{AC}) \text{ FL} + 0.0316 (\text{BPD}) + 0.0457(\text{AC}) + 0.1623 (\text{FL}).$$

Data initially collected on proforma was then shifted to SPSS. Statistical analysis was performed with SPSS version 10. The mean, maximum, minimum, standard deviation of estimated fetal weight and actual fetal weight. Was calculated and p value was calculated to evaluate the accuracy of ultrasound in fetal weight assessment.

RESULTS

The number of patients comprising the study was fifty. Selection of patients was according to inclusion and exclusion criteria. All patients were referred by a gynecologist to radiology department and trans abdominal ultrasound was performed. All fetal parameters were calculated and fetal Hadlock et al formula III for fetal weight estimation was used. Actual fetal weight was taken after delivery and was compared to the estimated weight. Mean of estimated fetal weight was 2083±196.39. Mean of actual fetal weight was 2913±343.78. After applying the paired t test. P value was calculated which was .000. This means that our result was statistically insignificant and ultrasound estimated fetal weight was not accurate. The standard error of significance was also measured between two means which was 55.98. This difference of standard error was not even equal to the actual difference between the two means. So the result of our study was statistically insignificant which means that ultrasound estimated fetal weight was not accurate. Ultrasound estimated fetal weight should not be used as a gold standard

while considering the management of macrocosmic or low birth weight.

Table 1: Descriptive statistics

Variable	N	Minimum	Maximum	Mean	S.D
Estimated fetal weight	50	1990	2974	2083.36	196.29
Actual fetal weight	50	2000	4000	2913.20	343.78

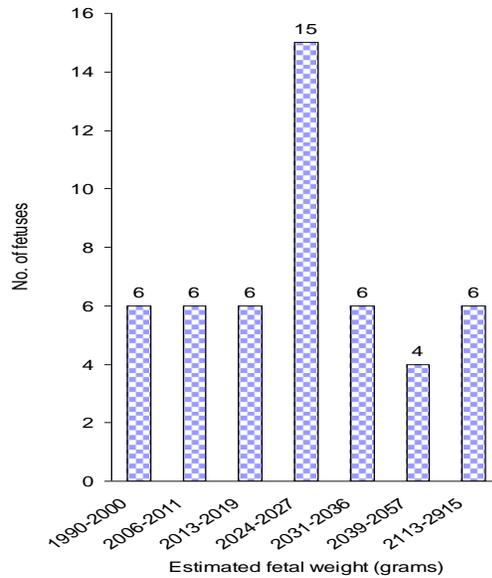


Fig.1: Distribution of fetuses according estimated fetal weight

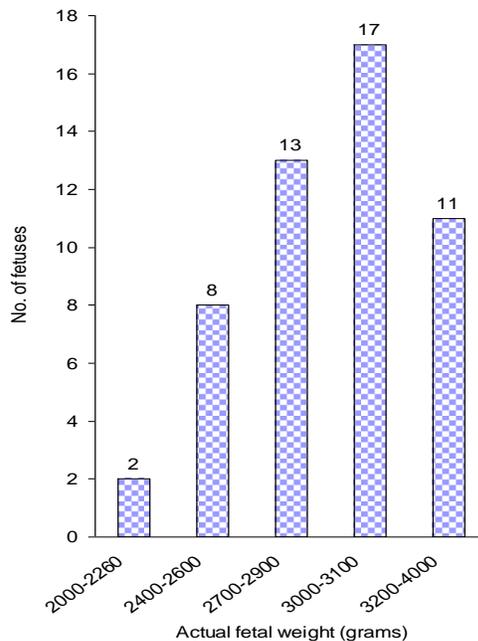


Fig.2: Distribution of fetuses according actual fetal weight

DISCUSSION

The prediction of fetal weight is important in obstetrical practice, as many decision depends on this .e.g. in macrosomia decision will be different and in low birth weight management will be totally different⁵. So ultrasound is used in fetal weight estimation. Multiple studies are conducted and many regression models are made and multiple formulas have been tried but still fetal weight estimation is not accurate and weight predicted by ultrasound differs from actual fetal weight⁶. The ultrasound estimation of fetal weight in term pregnancies is used to determine growth, and this may affect the timing and route of delivery. Although antenatal care has focused more on the diagnosis of fetal growth restriction⁶.

The delivery of macrosomic babies are associated with higher rates of adverse outcomes for both mother and baby in comparison to the delivery of normal weight babies. Increased risks to the large infant include shoulder dystocia, brachial plexus injury, perinatal asphyxia, and neonatal death. Adverse maternal outcomes include prolonged labour, genital tract trauma, and postpartum hemorrhage⁷. 3D ultrasound and magnetic resonance imaging (MRI) are claimed to be more accurate in determining fetal volume and better in estimating fetal weight. However, both methods are time consuming, expensive and not widely available⁸⁻¹⁰.

In this section other studies in terms of technique, criteria and interpretation of results for ultrasonically prediction of fetal weight will be discussed and compared with our study. In 1984 Frank Hadlock conducted a study to demonstrate importance of femur length in addition to other fetal parameters in estimation of fetal weight. He tried to determine that addition of femur length improves accuracy of in utero ultrasonic fetal weight estimation¹¹. He studied 167 patients and took their fetal weight and then examined them within one week of delivery. statistically EFW and AFW was evaluated by step wise regression analysis and P value was ≤ 0.05 and study demonstrate that addition of FL to HC and AC can significantly improve in utero EFW, but they concluded in study that anthropological variations or subtle differences in imaging and measurement techniques may change the form of equation. However in our study we used fetal parameter of AC, BPD, FL. while HC was not used and these pregnancies were at 38 week of gestation and p value of my study was .000. Standard error of difference between two means were statistically insignificant which means that ultrasonically estimated fetal weight is not accurate.

Erak A pressman in 2000 studied 138 patients in 3rd trimester which were between 34 -39 weeks and

calculation was done by Hadlock et al formula for fetal weight. The results showed that $p=0.19$ and they have concluded that accurate prediction of birth weight with the help of ultrasound in between 34 and 39 week is possible, the difference is less and clinically non significant and this does not need serial u/s between 34 and 37 weeks¹². Our study is same as it includes patient of 38 week and Hadlock et al formula while p value is .000 which shows that the our results are statistically insignificant and EFW is not accurate.

Juozas kurmanavicius obtained data from 5612 pregnant women and used 4 formulae which included Campbell and williken, Shepard and 2 formulae of Hadlock and merz to calculate the acute fetal weight. Fetal parameters included in study were BPD, HC, AC and FL and divide the fetal weight in different categories. The results showed that Hadlock formulae were better among other formula and showed more stable results and intra class correlation co-efficient. In our study we used only one formula which was Hadlock et al and it did not show good result¹³.

Malden predanic in 2002 conducted a study to determine the accuracy of u/s estimated fetal weight performed by residents. They selected 671 patients and compared the accuracy of EFW with the level of experience of residents and they concluded that as the experience of resident increases more is the accuracy in fetal weight estimation and there is decrease in percent error and 70% estimates were within 10% of fetal weight. Fetal weights were obtained with the use of Shepard formula and Hadlock with the measurement of BPD and AC or FL and AC. Both the two formulas for EFW were analyzed by paired T test. P value ≤ 0.05 was deemed significant,¹⁴ Our studies was done by single sonologist and only one formula was used as compared to above study in which two formulae were taken and comparison of results of these formulae were done.

CONCLUSION

In conclusion, fetal weight estimation is important to diagnose perinatal complication and in the management of labor and delivery. Unfortunately, to estimate fetal weight by ultrasound have not been as accurate in predicting weight.¹⁵ Our study showed that ultrasound is not accurate method in fetal weight assessment and as there is difference in AFW and EFW, so the decision about the fate of patient should not be dependent on the ultrasound results but on clinical skills too. As our study was done on Pakistani population, this could be the reason due to which results of our study was statistically insignificant and Hadlock et al III formula is not best for the Pakistani

population. It has been stated that the measurements of biparietal diameter is inaccurate either because of engagement or moulding, however HC is not affected by these changes. FL and AC measurements are also not affected by these changes.¹⁶ In addition, the advent of 3-dimensional fetal sonography and MRI has generated optimism that these new technologies can improve estimations of fetal weight, but the advantages of these techniques have not yet been demonstrated.

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