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Accuracy of Prediction of Birth Weight by Fetal Ultrasound

Sumnima Acharya[1], Awadhesh Tiwari[1]

[1]Radiology Department, Lumbini Medical College, Palpa.

ABSTRACT

Introduction: Fetal weight estimation using ultrasonography (USG) is beneficial for the better feto-maternal outcome. This study was done to determine the accuracy of prediction of birth weight by fetal ultrasound.

Methods: This was a cross-sectional study carried out in the Department of Radio diagnosis, Lumbini Medical College and Teaching Hospital (LMCTH), Palpa, Nepal from1st June to 31st December 2018.Fetal weight was calculated by USG in 325 women using Hadlock's formula and correlated with birth weight.

Results: Our study showed that fetal ultrasound using Hadlock's formula has error in estimation of fetal weight by 189gm (SD: 111 gm).In 91.3% of the cases, there was an error of estimation by less than 10% compared to actual weight.

Conclusion: It can be concluded that sonographic estimation of birth weight can be recommended to yield a better prediction of birth weight and to further evaluate fetal well-being.

Keywords: Fetal weight; Fetal ultrasound; Hadlock's formula.

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Correspondence
Dr.Sumnima Acharya
Assistant Professor, Radiology Department
Lumbini Medical College, Palpa.
Email: doctorsumnima@gmail.com,
ORCID ID: 0000-0001-8612-671X
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INTRODUCTION

Fetal weight estimation using ultrasonography is useful in timing and mode of delivery of a pregnancy, which is beneficial for the better fetomaternal outcome.[1] There are basically three groups of birth weights that are: the low birth weight, the normal birth weight, and the macrosomic babies.[2] An Increased risk of newborn complications are associated with extremes of birth weight .[3] So recognition of these abnormalities i.e fetal growth restriction (FGR) and large for gestational age (LGA) fetuses are important.[4] Intrauterine growth restriction (IUGR) or fetal growth restriction (FGR) is defined as an estimated fetal weight (EFW)/abdominal circumference (AC) at one point in time during pregnancy being below 3rd percentile or EFW/AC below the 10th percentile for gestational age with deranged Doppler parameters.[5] Estimation of birth weight is very important for planning of delivery of very low birth weight baby, the route of delivery and for prenatal counselling.[6] Prematurity and low birth weights determine the neonatal survival and is an important factor for determining the perinatal morbidity and mortality.[7] LGA fetuses are those with a birth weight greater than the 90th percentile or >4000gm and are at risk of limb injuries during normal delivery leading to increased cesarean rate.[4,8]

Estimation of fetal weight has evolved from physical examination to fetal ultrasound. Hence accuracy of fetal weight estimation has increased significantly.[9,10] There are multiple formulae for the birth weight estimation using ultrasound.[11-17] Hadock's formula is commonly used in Nepal for the estimation of fetal weight using ultrasonography.[18] Our study is directed to see the accuracy of fetal ultrasound in estimating fetal weight in the pregnant patients visiting our hospital.

METHODS

It was an observational, cross-sectional study carried out in the Department of Radio diagnosis, Lumbini Medical College and Teaching Hospital (LMCTH), Palpa, Nepal. The study was conducted after ethical approval from the Institutional Review Committee of our hospital. The study was conducted over a period of six months from 1st June to 31st December 2018. Hospital records (Patient's file sent to radiology department for USG) were reviewed from patients who were sent from Obstetrics and gynecology OPD/ward with full term pregnancy who came for delivery. Exclusion criteria included multiple pregnancy, preterm birth, intrauterine growth retardation and delivery done more than seven days after USG. Ultrasound examinations were performed by experienced radiologists using standard techniques. Hadlock's formula was used to calculate fetal weight. Observations during the study of each subjects were recorded in an individual case proforma. The case proforma contained all informations regarding the admission details, general particulars like: name, age, Last menstrual period(LMP), Average gestational age (AGA) by date of ultrasound, USG findings including Femoral length(FL),Biparietal diameter(BPD),Head circumference(HC),Abdominal circumference(AC),AGA by USG, Estimated fetal weight(EFW),Amniotic fluid index (AFI),Birth weight of new born baby, date of delivery, mode of delivery. Some informations were recorded in department of radio diagnosis at the time of USG and remaining relevant informations like date, time, mode of delivery, membrane rupture time, and birth weight of new born baby were recorded from discharge summary. Eventually, USG estimated fetal weight were compared with the birth weight of new born baby. We collected the data in Microsoft Excel 2007 and imported it to Statistical Package for the Social Science (SPSS™), version 16, for the statistical analysis .The absolute error in birth weight prediction was calculated as the absolute value of the difference between the predicted and actual birth weight. The negative values indicate an underestimation of birth weight and positive values indicated overestimation of birth weight. The absolute percent error was calculated by dividing the absolute error in birth weight prediction by the actual birth weight multiplied by 100. Mean error was calculated. Level of significance was set at $p < 0.05$.

RESULTS

The study included 325 patients. The gestational age was between 37 weeks and 42.4 weeks. The age range of patients was between 15-41 years, with a mean of 24.6 years. The range of actual birth weight was between 1.93-4.51 kg with a mean of 2.97 ± 0.424kg. The mean error in the estimation of birth weight was 189gm (SD: 111 gm).In average, ultrasound overestimate the birth weight by 157 gm (SD: 154gm) and underestimate by 154gm (SD: 108gm). In 49.53% of the cases, fetal ultrasound underestimated the birth

weight and in 50.46% overestimated the birth weight. Twenty eight (8.6%) out of 325 estimates were more than 10% from the actual weight and 91.3% estimates less than 10% from actual birth weight.

Table1. Maternal and Infant Demographics

Characteristics	Mean(Range)
Maternal age(in yrs)	24.6(15-41)
Gestational age at delivery(wks)	39wks5days(37-42.4)
Actual Birth weight(kg)±SD	2.99±0.424(1.93-4.51)
Estimated birth weight(kg)±SD	2.97±0.407(2.08-4.28)

Table 2.Mean Error in birth weight prediction

Characteristics	Mean(kg)±SD
Overestimate	0.157±0.154
Underestimate	0.154±0.108
Absolute	0.189±0.111
Estimate error>10% of ABW-28(8.6%) and <10% of ABW-297(91.3%).	

Table 3. Error estimation

Characteristic	Number(percentage)
Overestimate	164(50.46%)
Underestimate	161(49.53%)

DISCUSSION

For reducing perinatal morbidity and mortality, accurate estimation of antenatal fetal weight is necessary.[19] Many studies have been undertaken to find out the accurate methods of estimation of fetal weight .It includes clinical and ultrasound estimations. Clinical method involves estimation of uterine height and abdominal girth measured at the level of umbilicus.[18] Fetal weight can be measured via ultrasound using abdominal circumference (AC) alone [12],AC and biparietal diameter(BPD) [13] ,AC ,BPD and femur length.[15] Up to 10% of actual birth weight measured antenatally using ultrasound is considered acceptable.[18]

Antenatal birth weight prediction by Parvathavarthini et al was accurate in around 67% of cases. The mean weight of the 100 babies monitored in the study was 2984 grams, ranging from 2000 to 4500gm. Percentage error was least with USG which is almost comparable to our findings.[19]

Bajracharya J et al conducted a study on accuracy of prediction of birth weight by fetal USG and found that gestational age was between 37 weeks and 42 weeks. The age range of patients was between 18-40 years, with a mean of 25.51 years. The range of actual birth weight was between 2.11-4.9 kg with a mean of 3.07. The mean error in the estimation of birth weight was 290gm (CI: 250-330 gm).In 56% of the cases, fetal ultrasound overestimated the birth weight and in 36.67% it underestimated the birth weight. In average, ultrasound overestimated by 370 gm (CI: 320-420 gm) and underestimated the birth weight by 220 gm (CI: 160280gm).[1] Most of the above findings are relatable to our study.

Most of the studies showed that about 75% of the estimates are within 10% of the actual weight.[6,10] and other studies also showed high correlation between EFW and birth weight[2,11] and this study shows 91.3% estimates less than 10% from actual birth weight. So the ultrasound method is generally a better predictor of the actual birth weight than the clinical method, and thus should be used in estimating the actual birth weight when accessible.

We also need to keep in mind that ultrasound measurements are operator dependent. There can be high percentage of error during estimation of fetal weight as it is operator dependent. [18] There is a learning curve for ultrasonographic estimates of fetal weight, with a significant decrease in the percent error seen with advancing training and experience.[9]

CONCLUSION

From the results of the present study it can be concluded that sonographic estimation of birth weight can be recommended to yield a better prediction of birth weight and to further evaluate fetal well-being.

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