



Diagnostic Accuracy of Ultrasonography for the Detection of Foetal Weight



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Abstract

Background: Ultrasonography is a very useful diagnostic tool for the detection of foetal weight. **Objective:** The purpose of the present study was to validate the ultrasonography for the detection of foetal weight. **Methodology:** This prospective cohort study was carried out in the Department of Obstetrics & Gynaecology at Rajshahi Medical Hospital, Rajshahi, Bangladesh from July 2012 to June 2014 for a period of 2(two) years. Pregnant women with known gestational age at term (38 to 40 weeks of pregnancy), singleton pregnancy with longitudinal lie were included in this study. The patient was then taken to Dept. of Radiology & Imaging, RMCH. Ultrasonographic estimation of foetal weight was done from estimation of foetal abdominal circumference (AC), biparietal diameter (BPD) and foetal femur length (FL). Actual birth weights of babies were measured soon after their birth. The BPD, AC and FL were measured in centimetres and foetal weight was measured in grams. Actual birth weight is the first weight of now-born obtained after birth. This weight was measured within the first hour of life. **Result:** A total number of 245 pregnant women in term pregnancy were recruited as per inclusion and exclusion criteria. Majority of the women [91(37.1%)] belonged to the age group 19 to 29 years which was 174(71.0%) cases. Low birth weight was found in 12(4.9%) cases ultrasonographic examination and actual low birth weight was found in 15(6.0%) cases. Overweight was found in 13(5.2%) cases ultrasonographic examination and actual birth overweight was found in 9(3.7%) cases. The mean value and SD of foetal weight measured by USG was 2870.41 gms and 424.84 respectively. In case of actual birth weight, the mean and SD was 2936.20 gms and 456.71 respectively ($p = >0.05$). **Conclusion:** In conclusion estimation of foetal weight by ultrasonography is not significantly varied. [*Journal of National Institute of Neurosciences Bangladesh, January 2023;9(1):76-80*]

Keywords: Foetal weight; Clinical fetal weight; actual weight

Introduction

Fetal weight is one of the determinants of outcome of pregnancies and also a major determinant of infant mortality in the first year of life¹. Pre-natal fetal weight estimation, as an important aspect of routine obstetric care, helps clinicians to prepare for anticipated preterm deliveries, and to settle for the optimal delivery route².

Pre-natal fetal weight prediction is helpful, for instance, in determining intra-uterine growth restriction (IUGR) which is necessary in planning for perinatal management of such babies²⁻³. Maternal risks associated with the delivery of an excessively large fetus include birth canal

and pelvic floor injuries, as well as postpartum hemorrhage⁴. The incidence of cephalopelvic disproportion (CPD) is also higher among macrosomic fetuses compared with microsomic ones with such excessive weight fetuses often requiring 'operative vaginal delivery or cesarean delivery'⁵. Low birth weight infants born before term have a high incidence of respiratory distress syndrome with high mortality. Foetal malnutrition leads to perinatal asphyxia and meconium aspiration syndrome. Low birth weight associated with birth asphyxia increases the risk of death in the neonatal period⁵. During the first 72 hours of life LBW babies

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frequently develop symptomatic hypoglycaemia which may be lethal if not quickly recognized and treated.

Sonography is widely used for weight estimation because it is objective and reproducible⁶. There is constant search for effective methods for identifying the foetus at risk in rural based society with poor literacy status and inadequate health facilities. Identification of risk baby either low birth weight (LBW) or macrosomic should receive highest priority to provide effective minimal perinatal and maternal health care⁷. Antenatal estimation of foetal weight in uterus is still a challenging affair to an obstetrician. Ultrasound determines the foetal weight by measuring different foetal anatomical parameters such as femur length, abdominal circumference and biparietal diameter⁸. Sonographic estimation is more objectives, reproducible and involves a well-defined measurement procedure. Therefore, the purpose of the present study was to validate the ultrasonography for the detection of foetal weight.

Methodology

Study Settings and Population: This was an analytic type of single centered prospective cohort study. This study was carried out in the Department of Obstetrics & Gynaecology at Rajshahi Medical Hospital, Rajshahi, Bangladesh from July 2012 to June 2014 for a period of 2(two) years. This study was carried on the pregnant women attending IPD and OPD in the Department of Obstetrics & Gynaecology at Rajshahi Medical Hospital, Rajshahi, Bangladesh. Pregnant women with known gestational age at term (38 to 40 weeks of pregnancy), singleton pregnancy with longitudinal lie were included in this study. Malpresentation, multiple pregnancy, dead fetus, congenital malformation of fetus, patient having gestational diabetes mellitus (GDM) or chronic hypertension, pre-eclampsia (PE) and eclampsia, patient with history of premature rupture of membrane (PROM), antepartum haemorrhage (APH) were excluded from this study.

Study Procedure: Recruitment was done daily from Department of Obstetrics & Gynaecology, Rajshahi Medical College Hospital, Rajshahi. Obtaining the inform consent, a proper history was taken from the patient and a clinical examination was done. All information was collected in a pre-designed data sheet. The patient was then taken to Dept. of Radiology & Imaging, RMCH. Ultrasonographic estimation of foetal weight was done from estimation of foetal abdominal circumference (AC), biparietal diameter (BPD) and

foetal femur length (FL). Actual birth weights of babies were measured soon after their birth. All the weights measured by ultrasound were recorded in the data sheet. The ultrasonic measurements of the foetal weight were made with a linear array real time B mode ultrasound equipped with a 3.5 MHZ transducer. Ultrasound velocity was 1540 m/sec. The measurements were taken with screen calibre on the freeze picture. The sonographic estimation of foetal weight was done by using the model proposed by Hadlock et al⁸ measured by measuring different parameters such as biparietal diameter (BPD), abdominal circumference (AC) and femur length (FL). The BPD, AC and FL were measured in centimetres and foetal weight was measured in grams by applying the formula proposed by Hadlock et al⁸. The same observer performed all the ultrasonographic measurements. Actual birth weight is the first weight of now-born obtained after birth. This weight was measured within the first hour of life. They were weighed naked.

Statistical Analysis: The data were analyzed with the help of SPSS program. Paired “t” test and “Correlation coefficient” test performed to determine the difference among various types of measurement of foetal weight. The relationship of actual birth weight with clinical and ultrasonographic estimated weights were determined separately by using correlation coefficient test. For statistical significance p value was taken ≤ 0.05 . Permission was taken from the Ethical Review Committee (ERC) of the Rajshahi Medical College, Rajshahi before conducting the research. Informed written consent was taken from each study subjects before history taking and clinical examination.

Ethical Consideration: This study was conducted in accordance with the principles of good clinical practice and declaration of Helsinki. Ethical permission was obtained from the Ethics Review Committee of National Institute of Neurosciences & Hospital, Dhaka. (Memo no: 2016/06/09, Date: 27/06/2016). All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the local ethics committee. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and analyzed using the coding system.

Results

A total number of 245 pregnant women in term pregnancy were recruited as per inclusion and exclusion criteria. Majority of the women [91(37.1%)] belonged to the age group 25 – 29 years, 83 (33.9%) in the age group 19 – 24 years, 19.6% in the age group 30-34 years and 9.4% in the age group 35-39 yrs (Table 1).

Table 1: Age distribution of the Study Subjects

Age Groups	Frequency	Percentage
19 to 29 yrs	174	71.0
30 to 39 yrs	71	29.0
Total	245	100.0

Low birth weight was found in 12(4.9%) cases ultrasonographic examination and actual low birth weight was found in 15(6.0%) cases. Normal birth weight was found in 220(89.9%) cases ultrasonographic examination and actual normal birth weight was found in 221(90.3%) cases. Overweight was found in 13(5.2%) cases ultrasonographic examination and actual birth overweight was found in 9(3.7%) cases (Table 2).

Table 2: Relationship between Ultrasonographic Foetal weight and Actual Birth weight

Weight (gms)	USG FW	Actual BW
Low Birth Weight	12(4.9%)	15(6.0%)
Normal Birth Weight	220(89.9%)	221(90.3%)
Overweight	13(5.2%)	9(3.7%)
Total	245(100.0%)	245(100.0%)

Low Birth Weight= \leq 2499; Normal Birth Weight=2500-3999; Overweight= \geq 4000

Table 3 shows about foetal weight estimated by USG, the mean value and SD was 2870.41 gms and 424.84 respectively. In case of actual birth weight, the mean and SD was 2936.20 gms and 456.71 respectively. In case of Actual birth weight and foetal weight estimated by USG, the difference was proved to be statistically not significant ($t= 4.69$, $df = 244$, $p = >0.05$).

Table 3: Difference of Mean between Ultrasonographic foetal weight and Actual Birth weight

Weight	Mean \pm SD	P value
USG FW	2870.41 \pm 424.84	>0.05
Actual BW	2936.20 \pm 456.71	

Discussion

As foetal weight cannot be measured directly, it must be estimated from foetal or maternal anatomic parameters. Early methods to predict birth weight with an ultrasound technique were based on measurements of foetal abdominal circumference and bi-parietal diameter⁹. The accuracy of estimation of foetal weight was later improved by the incorporation of foetal femur length along with bi-parietal diameter and abdominal circumference¹⁰. Sonography is widely used for weight estimation because it is objective, reproducible and involves a well-defined measurement procedure. Clinical estimation is subjective depends on many factors, less well defined and measurements are variable. The present study was a cross-sectional comparative study carried out in the department of Obstetrics and Gynecology of Rajshahi Medical College Hospital from July 2012 to June 2014. The study was designed to compare the accuracy of foetal weight estimated clinically by Johson’s formula and ultrasonographically by Hadlock formula. A total of 245 women with singleton pregnancy and longitudinal lie at 38-40 weeks of gestation were studied. In the current study estimations of foetal weight by clinical and ultrasonographic methods were obtained independently by the different observers, & finally compared with actual birth weight.

There are few studies including present one have compared the accuracy of foetal weight estimation by clinical and ultrasonographic methods. The majority of the studies like Paterson¹¹, Raman et al¹², Chauhan et al¹³, Shamley and London¹⁴ are relatively similar and are included the women of term pregnancies. The present study also included only term pregnancies. The studies of Rahman et al¹² and Chauhan et al¹³ showed that clinical estimation was significantly more accurate than sonographic prediction. However, in this study it has been found that sonographic estimation is more accurate than clinical estimation. In this study, error of clinical estimation was statistically higher than ultrasonography estimation and it was supported by Shamley and London¹⁴.

Shamley and London¹⁴ noted that the error of clinical estimation was statistically higher than that for ultrasonographic estimation by the Hadlock et al⁸ and Shepard et al⁹ formulas. These results were similar to other two studies performed by Sabbagha et al¹⁵ and Rose and McCallum¹⁶. Patterson¹¹ also noted that clinical estimation was less accurate than ultrasonographic estimation by Compbell formula but

was comparable to the Warsof et al¹⁷ formula for ultrasonographic estimation. Both formulas were more accurate than clinical estimation in the presence of oligohydramnios or engagement of the foetal head. Paired 't' test was conducted to find out the differences between the actual birth weight, estimated foetal weight by USG and clinical estimation. The study showed that the mean value of clinical estimation of foetal weight was 3283.27 gms and. In case of actual birth weight, the mean was 2936.20 gms. Foetal weight estimated by USG, the mean value was 2870.41 gms. Sherman et al¹⁸ showed that birth weight ranges between 2500 to 4000 grams were detected more accurately by clinical method than ultrasonography but it differs from me. In present study only 34% of clinical estimate were within 10% error of actual birth weight. Sherman et al¹⁸ showed that somewhat lower accuracy of sonographic estimation was due to foetal weight within one week prior to delivery. They also reported that both clinical and ultrasonic estimation generally underestimates the weight of the macrosomic foetus and there was a tendency toward overestimation in cases of low birth weight. A large study by Benacerraf et al¹⁹ demonstrated that 74% of the ultrasonographic estimation of foetal weight was within 10% of the actual birth weight. This is a more or less correlated with present study.

Conclusion

In conclusion estimation of foetal weight by ultrasonography is not significantly varied. Estimation of weight in both methods used separate and independent formula. The present study suggests that ultrasonographic estimate of birth weight is sufficient to assess foetal weight in term pregnancy.

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Data Availability

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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