Actual birth weight Prediction at term using Clinical and Ultrasound methods at Federal Medical Centre, Keffi, Nasarawa State: A comparative Approach

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Abstract

Objective: The study sought to compare the predictive accuracy of clinical and ultrasound fetal weight estimation in predicting the actual birth weight of pregnant women at term at the FMC, Keffi, North central Nigeria.

Materials and Methods: This study was a cross-sectional study that enrolled 360 consecutive pregnant women at term (37 weeks + 0day - 41weeks +6days), who met the inclusion criteria between 10th December 2018 to 25th July 2019. Informed consent was obtained from participants and a proforma was interviewer-administered. The clinical estimate was done using the Dare's formula in the lying- in ward and labour ward. The ultrasound fetal weight estimation was done using an ultrasound scan machine imputed with the Hadlock formula mode (BPD, HC, AC, and FL) while the actual birth weight was measured in the labour room using the infant weighing scale. The data collected were analyzed using the Pearson's Chi-square or Fisher's exact test as appropriate, Pearson's correlation analysis and student’s t test. Accuracy was determined using percentage error, absolute error, and proportion of estimates within 10% of actual birth weight; and compared using the Poisson's z-test for two proportions. All analyses were performed, using the IBM SPSS Statistics for Windows, version 20.0. (IBM Corp., Armonk, N.Y., USA) and Minitab, version 18.

Results: Analysis showed that the clinical fetal weight estimation within 10% of the actual birth weight was not significantly lower than that of ultrasound fetal weight estimation for babies of all birth weight (41.5% vs. 55.0%, P = 0.064). The actual birth weight had a strong correlation with both clinical and ultrasound fetal weight estimation (r = 0.53, P<0.001 and r = 0.55, P < 0.001 respectively). The mean percentage error and mean absolute percentage error for normal weight babies (2.5- 3.99kg) was significantly higher in clinical method than ultrasound method (-13.29kg vs. 4.49 kg, P< 0.001) and (14.14kg vs. 9.47 kg, P< 0.001) respectively. Overall in most cases, the clinical method of fetal weight estimation overestimated the actual birth weight.

Conclusion: It was concluded that, ultrasound method of fetal weight estimation is a better predictor of actual birth weight than the clinical method. However, clinical weight estimation can still be used in a low-resource setting such as ours.

Introduction

The role of Fetal weight assessment cannot be over emphasized during antenatal care, labour management and delivery. Accurate pre-natal fetal weight estimation in late pregnancy and labour is vital to a successful outcome of labour and delivery. It guides the obstetrician in deciding and preparing for preterm deliveries, instrumental vaginal delivery, trial of labour after caesarean section, assisted vaginal breech delivery and elective caesarean section for patients with suspected fetal macrosomia. Peri-natal morbidity and mortality rates are very high in our environment and this problem is largely
related to prematurity and low birth weights. Basically, group of birth weights that are important to the clinicians are the low birth weight (1.5-2.49kg), the normal birth weight (2.5 -3.99kg) and the macrosomic babies (≥ 4kg).

Accurate estimation of fetal weight at different gestational ages is of important when considering the mode of delivery either vaginally or by caesarean section. This consideration is more important in our environment where high aversion for caesarean delivery is prevalent and good neonatal facilities are not readily available.

Vaginal delivery of macrosomic fetuses is a major challenge as it will require considerable attention by an experienced Obstetrician and preparedness for operative delivery. Both low birth weight and excessive fetal weight are associated with an increased risk of newborn complication during labour, delivery and peuperium. Peri-natal complications associated with low birth weight include either preterm delivery or intra-uterine growth restriction (IUGR) or both, while complications associated with delivery of macrosomic fetuses include prolonged labour, shoulder dystocia, brachial plexus injury, bony injuries and intrapartum asphyxia. Maternal risks associated with delivery of a very large fetus include birth canal and pelvic floor injuries, as well as postpartum haemorrhage.

Fetal weight estimation can be predicted by two main methods which are: clinical and radiological methods. Radiological method of fetal weight estimation involves the use of magnetic resonance imaging and ultrasonography. In clinical obstetrics practice, there is a tendency to rely on available technology and ignore clinical judgment, which can lead to loss of the skill to estimate fetal weight clinically by clinicians.

The study of an alternative method of fetal weight estimation is imperative in resource constraint settings such as the northern part of Nigeria, where sonographic method of fetal weight estimation is not readily available or where its availability is restricted due to high cost and proficiency of the sonologist. Therefore, this study set to compare the predictive accuracy of clinical method of fetal weight estimation and ultrasound method of fetal weight estimation in predicting the actual birth weight at the Federal Medical Centre, Keffi, Northern Central Nigeria.

**Methods**

**Study area and period**

The study was conducted at the Federal Medical Center, Keffi, North Central, Nigeria. The Centre is located in Keffi town in Keffi Local Government Area of Nasarawa State, North central Nigeria. The Department of O& G is a 40 bed capacity unit, which has an average of 1200 total deliveries every year; it is involved in the training of house officers, resident doctors (Junior/Senior) with consultants across specialties. Federal Medical Centre Keffi is a referral hospital serving Nasarawa State and other neighboring states like Kaduna, Kogi and the Federal Capital Territory Abuja. Keffi is a cosmopolitan city inhabited by about
92,664 people (as at the 2006 census National Population Commission). It has a total land mass of approximately 140km$^2$. The research study conducted from 10$^{th}$ December 2018 to 25th July 2019.

**Study design**

The study was a cross-sectional study which recruited a total of 360 pregnant women at term (37 weeks + 0 day - 41 weeks + 6 days), who met the inclusion criteria and consented were consecutively recruited until sample size was completed at the Federal Medical Center, Keffi, North Central, Nigeria. Informed consent was obtained from participants and a proforma was filled by the researchers. The clinical estimate was done using the Dare’s formula (estimated foetal weight in kilogram= Symphysiofundal height x abdominal girth at the level of umbilicus/1000 ± 0.05kg).$^{11}$ in the lying-in ward and labour ward. The ultrasound fetal weight estimation was done using an ultrasound scan machine imputed with the Hadlock Formula mode (BPD, HC, AC, and FL).$^{12}$ The actual birth weight was measured in the labour room using the infant weighing scale which was corrected to zero to ensure reliability of measurement.

**Sample size determination**

The sample size was calculated, using the Cochrane’s Formula$^{13}$ with a prevalence of 69.5% and an error margin of 5% at 95% confidence level. A total of 360 pregnant women at term were recruited for the study.

**Inclusion/Exclusion criteria**

This included women with singleton term pregnancy, presenting in labour, planned for induction or caesarean section. While women with the following conditions were excluded - term pregnancy with maternal obesity (absolute weight > 90kg), confirmed fetal congenital anomaly / IUFD, preterm labour, multiple gestation, abdominal girth > 108cm, polyhydramnious / oligohydramnious, pregnant women presenting in second stage of labour with imminent delivery, patients in critical or emergency condition e.g. antepartum haemorrhage, severe cardiac disease, refusal to consent.

**Data collection**

The data collected was cleaned and analyzed using SPSS software version 25.0 and Minitab version 18. Accuracy was determined using percentage error, absolute error, and proportion of estimates within 10% of actual birth weight. This was compared using the Poisson’s z-test for two proportions.

**Discussion**

The mean actual birth weight in this study was 3.24 ± 0.42kg. This is in tandem with what was reported by Shittu et al in Ife, Nigeria $^5$ and Njoku et al in Calabar, Nigeria.$^2$ and slightly higher than 3.08 ± 0.61kg reported by Swende in Makurdi, Nigeria.$^{14}$ This is however significantly lower than value of 3.57 ± 0.60kg documented in the United Kingdom. This finding is in consonance with the report in literature which stated that birth weight of Caucasian babies is higher than that of Africans.$^{15}$ The reason for this
difference was not investigated in this study, but it may be due to several factors such as observer error, regional and socioeconomic factors.\textsuperscript{16}

In the same vein, the mean clinical fetal weight estimation for this study was 3.65 ± 0.34kg; when this was compared with the actual birth weight, the difference was found to be statistically significant (p < 0.001). While the mean for the ultrasound fetal weight estimation in this study was 3.07 ± 0.37kg, which when compared with the actual birth weight after delivery, the difference was found to be statistically significant (p < 0.001). It is clear that ultrasound estimation is better than clinical estimation (Dare) in predicting fetal weight. This finding is similar to that of Ugwu et al.,\textsuperscript{1} who reported that ultrasound method of fetal weight estimation was significantly more accurate than the clinical method. However this is in contrast with findings of 3.54 ± 633g and 3.14 ± 441g for clinical and ultrasound methods respectively by Njoku et al and some other studies.\textsuperscript{2,5} where they reported no significant difference. This may be due to the accuracy of ultrasound method in estimating birth at term in the studied population.

This study showed that the overall mean % error for both clinical and ultrasound methods were -13.78±12.33 and 4.38 ± 11.42, while the mean absolute % errors were 14.89 ± 12.54 and 9.81± 7.29 respectively. This means that clinical methods overestimated actual birth weights while ultrasound underestimated actual birth weight. The overall mean % error and mean absolute % error for clinical method was higher than that for ultrasound method and the difference was statistically significant. This result also applies to the normal birth weight category. This finding is similar to low values of mean % error of -6.6 ±381g and means absolute % error of 104 ± 89g/kg for ultrasound reported by Chaun et al.\textsuperscript{17} Thus suggesting that ultrasound is more accurate than clinical method of fetal estimation.

The accuracy within 10% of actual birth weight in this study was 41.5% and 55.0% for both clinical fetal weight estimation and ultrasound fetal weight estimation respectively for all birth weight categories. This was comparatively similar to the findings of 35.0% and 67.5% for clinical and ultrasound fetal weight estimations reported by Ugwu et al in Enugu, Nigeria and 75% for ultrasound fetal weight estimation reported by Tawe et al in Jos, Nigeria.\textsuperscript{1,18} However this result was at variance with the findings of 70% and 68% for clinical and ultrasound fetal estimations reported by Shittu et al in Ife, Nigeria and other reporters in Calabar,\textsuperscript{2} Nigeria and in Kenyatta, Kenya.\textsuperscript{19} The finding may be attributed to improvement in skills and knowledge of scanning in recent time.

In this study both methods of fetal weight estimation, underestimated the actual birth weight for macrosomic babies (> 4kg), this difference were statistically significant (p <0.001) but the estimate within 10% of actual birth weight was not significant (p = 0.140). This finding was similar to the finding of Shittu et al\textsuperscript{5}, where no significant difference was found in the estimate within 10% of actual birth weight (p=0.76), but contradict the finding of Ugwu et al\textsuperscript{1} who reported a significant difference (p = 0.009). A correlation analysis was done in this study between actual birth weight and estimated fetal weight using clinical and ultrasound methods. The findings showed that the correlation between actual birth weight and ultrasound method of fetal weight estimation was stronger (r = 0.55, P <0.001), as compared to the correlation between actual birth weight and clinical fetal weight estimation (r = 0.53, P < 0.001). This
finding was consistent with correlation coefficient of $r = 0.740$ and $r = 0.847$ ($p < 0.001$) for clinical and ultrasound fetal weight estimations respectively as reported by Njoku et al.\textsuperscript{2} but slightly different from correlation coefficients of $r = 0.71$ and $r = 0.69$ reported for clinical and ultrasound method by Ugwu et al.\textsuperscript{1} and other researcher like Shittu et al.\textsuperscript{5} Overestimation in this study may be due to confounders like placenta size.

**Recommendation for clinical practices**

This study recommends that ultrasound method should be used in estimating the actual birth weight whenever accessible by trained individuals. However clinical method of fetal weight estimation should not be jettisoned but remain a valuable alternative where the ultrasound is unavailable (it has a moderate level of accuracy in predicting the actual birth weight).

**Future research**

In view of the discrepancies in results from different researchers on this subject, it is proposed that there should be further researches conducted using larger sample drawn from various centres for the purpose of comparison.

**Conclusion**

The study clearly showed that ultrasound method of fetal weight estimation has higher predictive accuracy than clinical (Dare) method of fetal weight estimation and it correlated strongly with actual birth weight.

**Declarations**

**Funding**

The author did not get any funds to conduct this research

**Ethical approval**

The ethical approval for the conduct of this research was obtained from the ethical committee of Federal Medical Centre Keffi (FMC/KF/HREC/236/18). All participants consented to the study.

there is no competing interests.

**References**


Tables

Tables 1 to 6 are available in the Supplementary Files section

Supplementary Files

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