fortune Journals

Research Article

JOURNAL OF PEDIATRICS, PERINATOLOGY AND CHILD HEALTH

ISSN: 2641-7405

Comparative Study Between Clinical and Sonographic Estimation of Foetal Weight in 3rd Trimester

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Abstract

Background: Accurate estimation of foetal weight is of paramount importance in the management of labour and delivery. Both low birth weight and excessive fetal weight at delivery are associated with an increased risk of newton complications during labor and the poerperium.

Aim of the study: To compare the estimation of foetal weight by clinical assessment over ultrasonography at three trimesters of pregnancy.

Methods: This analytical cross-sectional study was conducted in the Department of Obstetrics & Gynecology, Shaheed Suhrawardy Medical College & Hospital. Dhaka from February 2013 to July 2013 for six (6) months. A total of 100 pregnant women with only singleton pregnancies were included. Pregnant women with polyhydramnios, Antepartum haemorrhage, eclampsia, oligohydramnios, obese and severely ill were omitted. Dare's formula (SFHxAG) was used for clinical methods.

Result: Most babies belonged to the birth weight category 2,500-3,500. The mean (SD) true birth weight was 2961(377) gm, the mean (SD) weight (USG) of the foetal was 2942(395) gm, and the mean (SD) clinical weight of the foetal was 3495(299) gm. Average errors were 534 gm and 248 gm in the clinical and USG methods, respectively. USG EFW correlated better with true foetal weight than the clinical foetal weight.

Conclusion: Foetal weight estimation is more accurate by abdominal ultrasonography than clinical assessment.

Keywords: Ultrasonography; Foetal; 3rd trimester

Introduction

Estimation of foetal weight is essential in daily obstetric practice, particularly close to term. It guides clinicians to finalize important categorical decisions [1]. Low birth weight and excessive foetal weight at delivery are both associated with an increased risk of neonatal complications during labour and the puerperium [2]. Depending on many factors, the optimal range for birth weight is thought to be 3,000-4,000 grams [1]. Various formulas to calculate EFBW (Estimated Foetal Body Weight) were used in daily clinical practice [3]. The limitations and sensitivity of these formulas have been investigated [4]. It is estimated that 16% of live-born infants have low birth weight, a condition associated with high perinatal morbidity and mortality [5]. Foctal macrosomia is associated with maternal morbidity, shoulder dystocia, birth asphyxia, and birth trauma [6]. Many researchers have attempted to estimate fetal weight using single or combined ultrasound measurements of the fetus [7]. Knowledge of expected birth weight is attractive to clinicians as it is an important variable affecting perinatal mortality [8]. Fetal weight

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Citation: Jasmin Ara Zaman, Afreen Kabir Kheya, Fathima Sultana, Lizwana Nusrat Lia, Rezwan Sultana. Comparative Study Between Clinical and Sonographic Estimation of Foetal Weight in 3rd Trimester. Journal of Pediatrics, Perinatology and Child Health. 8 (2024): 98-104.

Received: June 01, 2024
Accepted: July 25, 2024
Published: July 12, 2024

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DOI:10.26502/jppch.74050188

estimation is thought to help predict fetal survival and make management decisions in the very low birth weight group (<1000 g) [9] and in managing the delivery of a large baby, where complications may occur [10]. The two main methods for predicting birth weight in current obstetrics are clinical techniques based on abdominal palpation of foetal parts and calculations based on fundal height and sonographic measures of skeletal foetal parts. These are then inserted into regression equations to derive estimated foetal weight [5]. Although some investigators consider sonographic estimates superior to clinical estimates, others, in comparing both techniques concurrently, conclude that they confer similar levels of accuracy [11-15]. Tactile assessment of foetal size is described by Dare et al. [16]. It is the oldest technique for assessing foetal weight through manual assessment of foetal size by obstetricians worldwide, i.e. by external palpation of the uterus and foetal parts [17]. This method is extensively used because it is both convenient and virtually costless. However, it has long been known as a subjective method associated with significant predictive errors [5]. It is both patient- and clinician-dependent for its success and less accurate for obese gravidas than non-obese, and there is significant inter-observer variation in the prediction of birth weight even among experienced clinicians [18]. Obstetric ultrasonography is a modern method for assessing foetal weight, which involves using foetal measurements obtained via ultrasonography. The advantage of this technique is that it relies on linear and planar measurements of in-utero foetal dimensions that are definable objectively and should be reproducible [5]. The early expectation that this method might provide an objective standard for identifying foetuses of abnormal size for gestational age was recently undermined by prospective studies that showed sonographic estimates of foetal weight to be no better than clinical palpation for predicting foetal weight [19,20]. Suzuki et al. [21] used ultrasound measurement of foetal heart volume to estimate foetal weight [21], while Paulos et al. [22] used foetal volume by ultrasound [22]. However, sonographic predictions are based on algorithms using various combinations of foetal parameters, such as abdominal circumference (AC), Femur length (FL), biparietal diameter (BPD), and head circumference (HC), both singly and in combination [5]. Obstetric sonographic assessment to obtain foetal biometric measurement to predict foetal weight has been integrated into the mainstream of obstetric practice during the past quarter century. The modern algorithms above are generally comparable in overall accuracy in predicting birth weight. When other sonographic foetal measurements are used for estimating foetal weight, e.g. humeral soft tissue thickness, ratio of subcutaneous tissue to femoral length, cheek-to-cheek distance, these non-standard measurements do not significantly improve the ability of obstetric sonography to help predict birth- weight, except in special patients' subgroup, e.g. mothers with diabetes [5]. Several technical limitations of the sonographic technique for estimating foetal weight are well-known. Among these are maternal obesity, oligohydramnios, and anterior placentation. Other disadvantages of ultrasonography are that it is complicated and labour-intensive, potentially limited by suboptimal visualization of foetal structure. It also requires costly sonographic equipment and specially trained personnel [5]. Although such expensive imaging equipment is widely available in developed countries, this is generally not the case in developing nations like ours, where medical resources are scarce. All currently available techniques for estimating foetal weight have significant inaccuracy, and various studies have been done to compare the accuracy of different estimation methods. Limiting the potential complications associated with the birth of both small and excessively large foetuses requires that accurate estimation of foetal weight occurs in advance of deliveries [5]. The present study aimed to resolve these controversies and determine the more accurate method of foetal-weight estimation by ultrasonography and clinical assessment, thereby improving conditions' management.

Methodology and Materials

This study constitutes an analytical cross-sectional investigation focusing on mothers undergoing singleton pregnancies admitted for scheduled deliveries at term, either through an elective cesarean section or induction of labor, within the Department of Obstetrics & Gynecology at Shaheed Suhrawardy Medical College & Hospital, Dhaka, Bangladesh. The study spanned six months, from February 2013 to July 2013, when 100 patients were enrolled, and their data analyzed. Approval for this study was obtained from the Local Ethical Committee of BCPS before its commencement.

Inclusion criteria:

- All pregnant women with singleton pregnancy.
- The age group is from 15 years to 45 years.
- Participants who will give consent and are willing to comply with the study procedure.

Exclusion criteria:

- Obese patients (weight more than 90 kg).
- Patients with polyhydramnios.
- Pre-term labour.
- Ruptured membranes.
- Abnormal lie and presentation.
- Multiple pregnancies.
- Antepartum haemorrhage.
- Eclampsia.
- Obvious congenital abnormalities.
- Oligohydramnios.

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DOI:10.26502/jppch.74050188

- Anteriorly inserted placenta.
- Poor visualization of the foetal part.
- Severely ill patients.
- Patients or attendants are unwilling to take part in the study.

Clinical assessment

Only the senior resident assigned to the labour ward carried out in-utero estimation of foetal weight using the same flexible tape measure calibrated in centimetres. Using his tape, fundal height was measured from the highest point on the uterine fundus to the midpoint of the upper border of the symphysis pubis, using the thumb to sustain the tape while attempting to reach the upper border of the symphysis pubis. Measurement was made using the tape reverse-side up to forestall any bias. The abdominal circumference is also measured at the umbilicus level. Fundal height multiplied by abdominal girth measurement in centimetres is used for calculating fetal weight in grams.

Ultrasonographic measurement

A senior radiology unit resident sent the patient for ultrasonographic estimation using an abdominal sector 3.5 MHz transducer on the Sonace 3200 ultrasound machine designed by Advanced Technology Laboratories, Bothell, WA. Australia. Its formula for estimating foetal weight is the basis of biparietal diameter (BPD), abdominal circumference (AC), and femural length (FL) [23]. Both estimates are documented in a chart.

Newborn weight

After delivery, experienced midwives weighed newborn babies within 30 minutes of delivery employing a standard analog Waymaster (England) scale corrected for zero error. All pregnant women admitted to the hospital were recruited per inclusion and exclusion criteria. The relevant socio-demographic data of these women were collected and recorded. The clinical and ultrasound estimation of foetal weight in-utero and delivery of babies were measured and recorded in a pre-designed data collection sheet.

Data collection analysis

Data was collected using a preformed data collection sheet. The relevant socio-demographic data of these women were collected and recorded. The clinical and ultrasound estimation of foetal weight in-utero and delivery of babies were measured and recorded. Data was collected by the researcher herself. Computer-based statistical analysis was carried out with appropriate techniques and systems. All data were recorded systematically in preformed data collection form (questionnaire); quantitative data were expressed as mean and standard deviation, and qualitative data as frequency distribution and percentage. Statistical analysis was performed using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-17) (SPSS Inc, Chicago, IL, USA). A 95% confidence limit was taken. The summarized data was interpreted accordingly and was then presented in the form of tables.

Result

Table 1 shows the distribution of patients by age. Out of 100 patients, a maximum of 39% were in the age group 26-30 years, followed by 37% of patients and 24% of patients in the age group 21-25 years and 20 years, respectively. The Mean±SD age of the patients was 24.22±3.63 within the range of 18. Table 2 shows the patients' occupation, socioeconomic status and education status. Out of 100 patients, a maximum of 99% of the patients were housewives and housewives, and only 1% of the patients of occupation were nursing. Out of 100 patients, a maximum of 89% of patients' socioeconomic condition was average, and 11% was below average. The table also shows the distribution of the patient's education. Out of 100 patients, 12% of patients completed primary, 19% of patients were below SSC, a maximum of 31% of patients completed SSC, 29% of patients completed HSC, and 9% of patients graduated. Table 3 shows the distribution of patients by general examination. Out of 100 patients. 34% of patients had mild anaemia. 22% of patients had oedema. 2% of patients had mild thyroid problems. 22% of patients' JVP were not visible, and 78% of patients' JVP were not palpable. Table 4 shows the distribution of patients by physical examination. Mean±SD temperature of the patients was 98.51±0.13, the mean±SD pulse of the patients was 84.265.04, the mean±SD systolic BP of the patients was 109.76±9.60, the mean±SD diastolic BP of the patients was 68.62±8.00 and mean±SD respiratory rate of the patients was 18.04±1.42. Table 5 shows the distribution of patients by clinical examination. The mean ± SD fundal height of the patients was 36.01±0.89. The mean abdominal girth of the patients was 97.01±7.04. Table 6 shows the distribution of patients by USG findings. Mean±SD BPD of the patients was 91.80±3.68, and the mean±SD FL of the patients was 72.89±3.18. Table 7 shows the distribution of patients by foetal weights. mean±SD weight (clinical) of the foetal was 3495±299, mean±SD weight (USG) of the foetal was 2942±395 and Mean±SD true birth weight was 2961±377. Table 8 shows the distribution of cases according to birth weight. Of them, a maximum of 45% of cases were in group 2501-3000 gms, followed by 32% in group 3001-3500 gms, 18% in group 2001-2500 gms and 5% in group >3500 gms. Table 9 shows the average error in various fetal weight groups by clinical and USG methods. The mean average error represents the sum of the positive (over-estimation) and the negative (under-estimation) from actual birth weight. EFW in the clinical method had the highest average error in all weight groups except the >3500 gm group. Average errors are 534gm and 248 gm in the clinical and USG methods, respectively.

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DOI:10.26502/jppch.74050188

Table 10 shows percentage error in various foetal groups by clinical methods and USG. In 90% of the cases, the USG method correlated well with a true birth weight with an error of 15%, whereas in only 35% of cases, the clinical method correlated with a true birth weight with an error of 15%. Table 11 shows the correlation of foetal weight (true) with USG and clinical foetal weight. USG EFW correlated better with true foetal weight than clinical foetal weight.

Table 1: Age distribution of the study population.

Age(years)	Frequency (n)	Percentage (%)
≤20	24	24
21-25	37	37
26-30	39	39
Total	100	100
Mean±SD (Range)	24.22±3.63(18-30)	

Table 2: Distribution of the patients by occupation, socio economic status and education.

Variables	Frequency (n)	Percentage (%)
Occupation		
Housewife	99	99
Nursing	1	1
Socioeconomic Condition		
Average	89	89
Below Average	11	11
Education		
Primary	12	12
Below SSC	19	19
SSC	31	31
HSC	29	29
Graduation	9	9

Table 3: Distribution of patients by general examination (n=100).

General examination	Frequency (n)	Percentage (%)
Anaemia (mild)	34	34
Oedema		
Present	22	22
Mild	47	47
Thyroid (Mild)	2	2
JVP		
Not visible	22	22
Not Palpable	78	78

Table 4: Distribution of patients by physical examination (0-100).

Physical examination	Mean±SD	Min-Max
Temperature	98.51±0.13	98.00-99.0
Pulse	84.26±5.04	68.00-98.60
Systolic BP	109.76±9.60	100.00-140.0
Diastolic BP	68.62±8.00	50.00-86.0
Respiratory rate	18.04±1.42	16.00-20.00

Table 5: Distribution of patients by clinical examination (n=100).

Clinical examination	Mean±SD	Min-Max
Fundal height	36.01±0.89	34.00-41.00
Abdominal girth	97.01±7.04	85.00-120.00

Table 6: Distribution of patients by USG findings (n=100).

USG findings	Mean±SD	Min-Max
BPD	91.80±3.68	84.00-99.00
FL	72.89±3.18	65.70-79.00

Table 7: Distribution of different foetal weight (n=100).

General examination	Mean±SD	Min-Max
Foetal Weight (clinical)	3495±299	2992-4920
Foetal Weight (USG)	2942±395	1946-4223
True birth weight	2961±377	2300-3900

Table 8: Distribution of cases according to birth weight.

Birth weight (grams)	Mean±SD	Min-Max
2001-2500	18	18
2501-3000	45	45
3001-3500	32	32
>3500	5	5
Total	100	100

Table 9: Average error in various fetal weight groups by various methods.

True birth weight (gram)	2001-2500	2501-3000	3001-3500	>3500	All
Clinical method	776	622	328	188	534
USG	258	196	203	340	248

Table 10: Percentage error in various fetal groups by clinical methods and USG.

% error	Clinical method	USG
Up to 5%	0.14	0.4
Up to 10%	0.26	0.63
Up to 15%	0.35	0.9
Up to 20%	0.59	0.96
Up to 25%	0.71	0.96
>25%	1	1

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DOI:10.26502/jppch.74050188

Table 11: Correlation of foetal weight (absolute) with USG and clinical foetal weight (n=100).

Parameter	r value	p value
Foetal weight (clinical)	0.661	0.001
Foetal weight (USD)	0.625	0.001

Discussion

Estimation of EFW has become increasingly important in obstetric decision-making regarding induction of labour, evaluation of feto-pelvic disproportion and mode of delivery especially in vaginal birth. The aim of Obstetric practice is the delivery of a healthy baby with the least amount of maternal morbidity. Birth weight is important because its accurate estimation in utero gives a good estimate of the neonatal outcome. Various methods of fetal weight estimation have been used in clinical practice. Our study attempted to compare the clinical method (Dare's formula) and ultrasound EFW with True Birth Weight (TBW). The analytical cross-sectional study was conducted in the Department of Gynaecology & Obstetrics at Shaheed Suharwardy Medical College and Hospital. Dhaka. The study was conducted from February 2013 to July 2013 for six months. A total number of 100 pregnant women with singleton pregnancy were enrolled for this study. The distribution of study subjects by age is recorded. Out of 100 patients, a maximum of 39% were in the age group 26-30 years, followed by 37% of patients and 24% of patients in the age group 21-25 years and 20 years, respectively. Nahar et al. (2008) showed the same result in their study [24]. Mean±SD age of the patients was 24.22±3.63 within the range of 18-30 [25]. The distribution of the study subjects by occupation was recorded. Out of 100 patients, a maximum of 99% were housewives, and only 1% of occupation was nursing. The distribution of study subjects by socioeconomic condition was recorded. Out of 100 patients, a maximum of 89% of patients' socioeconomic condition was average, and 11% was below average. The distribution of study subjects by education was recorded. Out of 100 patients, a maximum of 31% completed SSC, 29% completed HSC, 19% were below SSC, 12% completed primary, and 9% graduated. The distribution of study subjects by general examination was recorded. Out of 100 patients, 34% of patients had mild anaemia, 60% of patients had oedema, and 2% of patients had mild thyroid problems: 22% of patients' JVP were not visible, and 78% of patients' JVP were not palpable. The distribution of study subjects by physical examination was recorded. The mean (SD) temperature of the patients was 98.51(0.13), the mean(SD) pulse of the patients was 84.26(5.04), the mean(SD) systolic BP of the patients was 109.76(9.60), the mean(SD) diastolic BP of the patients was 68.62 (8.00) and mean(SD) respiratory rate of the patients was 18.04(1.42). The distribution of study subjects by clinical examination and USG findings was recorded. The Mean(SD) fundal height of the patients was 36.01(0.89), the mean(SD) abdominal girth of the patients was 97.01(7.04), the mean (SD) BPD of the patients was 91.80(3.68), and the mean(SD) FL of the patients was 72.89(3.18) [26]. The distribution of study subjects by foetal weights was recorded. The mean(SD) clinical EFW was 3495(299) gm, the mean(SD) uEFW was 2942(395) gms, and the mean(SD) truck birth weight was 2961(377) gm. Almost the same result was seen in the study of Mortazavi and Akaberi, 2010 and the study of Nahar et al., 2008 [26,24]. The distribution of cases according to birth weight was recorded. Of them, a maximum of 45% of cases were in group 2501-3000 gms, followed by 32% in group 3001-3500 gms. 18% in group 2001-2500 gms and 5% in group >3500 gms. Similar to the present study results, Bhandary et al. (2004) and Chauhan et al. (2013) have reported that the maximum distribution of cases was in the 2501-3000 gm fetal weight group [27,28]. Clinical and USG methods recorded the average error in various fetal weight groups. The average error in all fetal weight groups except in >3500 gms was the least with USG, and in the >3500 gms group was the least with the clinical method. The same result was observed in the study of Bhandary et al. [27]. Average errors were 534 gm and 248 gm in the clinical and USG methods, respectively. Kumari et al. have reported that the average error was less in the USG method comparing the clinical (AG x SFH) method [29]. The maximum error in various fetal weight groups by clinical and USG methods was recorded. The clinical method overestimated foetal weight in all groups except the >3500gms group. The percentage error in various fetal groups by clinical methods and USG was recorded. 90% of cases were within 15% error of actual birth weight by USG, whereas only 35% were within 15% error of actual birth weight by clinical method. 85.5% of cases came within 15% of actual birth weight by both USG and AG X SFH methods in the study of Chauhan et al. [27] and Bhandary et al. [28]. The correlation of actual birth weight with USG EFW and clinical EFW was recorded; USG EFW had a better correlation with actual birth weight than clinical EFW. The same result also was shown in the study of Noumi et al. [30].

Limitations of the Study: The present study has some limitations. The study was conducted in a single center in Dhaka city, which may only represent part of the population. The sample size was small in the present study, which is also a limitation.

Conclusion and Recommendations

This study concludes that Foetal weight estimation is more accurate by abdominal ultrasonography than clinical assessment. Though USG predicts the fetal weight more accurately, the clinical method (AGxSFH), which is also equally good, should be used in day-to-day practice, especially in places where ultrasound is unavailable. Based on

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DOI:10.26502/jppch.74050188

the findings of the present study and analysis, the following recommendations are put forward-

- Further large-scale studies should be conducted.
- A multicentered study may be conducted.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee.

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