ACCURACY OF ULTRASOUND COMPARED TO CLINICAL ESTIMATE OF ESTIMATED FETAL WEIGHT

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ABSTRACT

Objective: To evaluate accuracy of ultrasonography with clinical examination in assessing fetal weight with birth weight in actual considering as the gold standard.

Methodology: From January to July 2022, the Department of Obstetrics and Gynaecology at Pak Emirates Military Hospital, Rawalpindi, conducted a study comparing Leopold's procedures and ultrasonic review for estimating fetal weight. Actual birth weight served as the gold standard. Data was collected from women starting at 34 weeks of gestational age. Neonatal outcomes and maternal demographic data were noted. Comparison metrics included overall absolute error, overall absolute percent error, and percent errors greater than 10% and 20%. Results highlighted the accuracy of both methods in estimating fetal weight.

Results: A total of 377 pregnant women with singleton term pregnancies were recruited for study with average gestational age 3of 8+4 weeks gestation including 65.7% primiparous women, 34.3% women were obese and 11.3% had gestational diabetes with 2.9% huge for gestational age infants. Statistical analysis revealed that a significant difference was noted for estimation of weights in favor of ultrasonic measures for all error estimation groups.

Conclusion: Ultrasound has significantly better accuracy in estimation of fetal weight as compared to clinical examination in pregnant women.

Keywords: Prenatal Ultrasonography; Fetal Weight; Birth Weight; Pregnancy; Midwife.

INTRODUCTION

The accurate assessment of fetal weight has crucial relevance while selecting the date and mode of delivery, particularly while suspecting macrosomia or growth limitation. The estimated fetal weight is commonly enquired about by the patient and estimated the obstetrician in all laboring patients. Fetal weight is an autonomous risk factor and is related to increased perinatal morbidity and mortality both in high as well as low birth weight cases.[1,2] Clinical estimation is of substantial importance as ultrasound is not always available and not frequently used in many areas of our society especially if we also take into account the areas deprived in health facilities.[3]

Clinical determination of fetal weight through Leopold's approach is more practical and in use since before the invention of ultrasonography, but variables like obesity, fibroids, increased liquor, etc., may occasionally influence the findings.[4] The maternal abdomen is palpated along with measurement of symphysis-fundal height, abdominal circumference and Leopold's maneuver to determine the size of the fetus and its relation to the maternal pelvis.[5] Macrosomia is characterized as a fetal birth weight > 4000 gm; inaccurate estimation of fetal weight may increase the risk during delivery, especially in fetal macrosomia.[6] Estimated fetal weight measurement by ultrasound uses the Headlock formula represented as: EFW: log10 (BW) = 1.3598 + 0.051(AC) + 0.1844(FL) – 0.0037(AC×FL.[7,8]

In the LMICs like Pakistan, clinical estimation of fetal weight at birth is more in practice as compared to the sonographic estimation in our hospital; therefore, we should know the comparison for alignment between clinical and sonographic fetal weight estimations in our hospital, so that we can comprehend the consequences in our population either underweight or overweight.[9-12] The purpose of the study is to compare the accuracy of ultrasound and clinical methods for the estimation of fetal weight.

METHODOLOGY

This comparative cross-sectional study was conducted at the obstetrics unit and nursing intensive care

unit of Pak Emirates Military Hospital, Rawalpindi from January 2022 to June 2022. Ethical approval was granted for this study by the ethical review board IREB; letter no. A/28/EC/330/2021b dated 28 July 2021. WHO's Sample Size Calculator calculated the sample size; non-probability consecutive sampling technique was used to gather the sample. Mothers with multiple pregnancies with anatomical abnormalities of the uterus were excluded.

In this cross-sectional research, we assessed the precision of clinical Leopold's method as opposed to ultrasonic estimates of fetal weight in grams, where the gold standard was considered to be the actual birth weight reported in Labour rooms of Obstetrics & Gynecology Department of Pak Emirates Military Hospital, Rawalpindi. All viable single fetuses comprising tiny for gestation (SGA) and large for gestation (LGA) fetuses were taken. Suspected brachycephalic fetuses with cephalic index > 85 and dolichocephalic fetuses with cephalic index < 75 were excluded. All women who were received at term as routine cases were screened for any risk factors including weight variations for both underweight and over-weight category, reportedly having gestational diabetes and hypertensive disorders, already having history of large for gestational age babies. (Table 1).

Fetal assessment was based on CTG (30 minutes) and ultrosonic assessment. The patient is examined after a general physical examination including the abdominal examination includes the evaluation of the fetal head into the maternal pelvis, the height of the fundus and Leopold's maneuvers to assess the size of the baby relative to the mother and clinical estimation of fetal weight. Fetal weight estimates by a doctor; with at least 3 years' experience; which is presented as a point estimate already rounded off to the nearest 100 g obtained, The sonographic assessment of fetal weight was done by Head lock method which was followed by routine care.

Maternal demographics were documented upon admission and neonatal information including fetal weight by sonography and by clinical estimate was recorded in the delivery suite. The impact of BMI on the clinical evaluation of fetal weight was investigated. The height whether self-reported or measured as well as weight which has to be measured at the time of admission of patients in Gynae and obstetric unit, maternal BMI also calculated and sub-categorized as: 18 kg/m^2, 18 to 25 kg/m^2, and > 25 kg/m^2.

The end result was to compare the weight estimate obtained by ultrasonography and clinical estimation to the birth weight, the gold standard measure, which encompasses overall absolute error, the overall absolute percent error, the absolute percent error greater than 10%, and absolute percent error greater than 20%. To the best of our knowledge, the estimations and extrapolations were carried out in accordance with techniques that had been approved. Table 1 depicts the median amount of time between the estimate and birth.

We conducted a descriptive analysis constituting of maternal age in years, body mass index (kg/m2), duration of pregnancy (weeks + 6/7 days), fetal birth weight in grams, parity, mode of delivery whether it is spontaneous delivery or the birth carried out by caesarean section, also including the risk factors related to maternal health profile like hypertension, gestational diabetes, preeclampsia) by calculating the mean as well as the standard deviation (SD). Absolute errors, which represent the difference in the estimated and observed weight at birth, were determined and provided as mean and SD for the Leopold and the Ultrasound measurements. We also reported the percentage of instances with absolute errors ≥ 500g (8), as this is relevant to general practice. Furthermore, we provided the mean standard deviation and absolute percent errors greater than 10%.

The paired T-test is used to assess whether there were any variations in the absolute errors found and absolute percent errors observed while comparing both estimates of Leopold and ultrasonic measures. The paired T-test was also used for analyzing the percentage of absolute errors that were 500 g or less, 10% or more, and 20% or more.

While assessing normal-weight and overweight pregnant females, we conducted the aforementioned experiment individually. We performed a descriptive analysis, individually for both the groups (here two sample test is used instead of paired tests), accounting the effect of body mass index on estimate errors. We divided the BMI data into three categories: 18 kg/m^2 as underweight, 18 to 25 kg/m^2 as normal weight, and those having weight greater than 25 kg/m^2 as overweight. SPSS 21.0 is used for statistical analysis.

RESULTS

Our group comprised of 377 patients with average gestational age of 38±4 weeks gestation comprising of 65.7% primiparous women, 34.3% obese women, 11.3% women with gestational diabetes, 2.9% women having infants large for gestational age. Demographic characteristics (Table 1). There is a substantial difference found between weight estimation favoring towards ultrasonography in all error estimation groups as demonstrated in Table 2.

Tests were done on pregnant women with BMI > 25 kg/m2 and ultrasonography was proven to be a superior modality for fetal weight assessment with p 0.000 with > 500g variation as demonstrated in Table 3. For all underweight pregnant women, both weight estimates of the baby's birth weight are accurate. (Table 4)

Table 1: Descriptive statistics for baseline characteristics of the cohort study

Patient Characteristics		N=377	%
Maternal age		30.5± 3	
Prim parous		248	65.7
Multiparous		129	34.3
Mean gestational age at the time of delivery		38+2/7 ±1.3	
Mean actual birth weight (g)		3253.12 ± 515.7	
Median time estimation to birth (in days) (median ± SD)		5.5±3.4	
Mode of Delivery	Normal vaginal	265	70.3
	Elective C section	54	14.3
	Emergency C section	58	15.4
Mean maternal BMI (kg/m2)(±SD)		23.82±3.68	
BMI < 25		323	85.9
BMI ≥ 25		54	14
Reduced fetal movements		37	9
Gestational diabetes		43	11.3
Large for gestational age		11	2.9
Chronic or gestational hypertension		40	10.6
Intra-hepatic cholestasis of pregnancy		29	7.7

Table 2: Accuracy between weight estimations and actual birth weight in the cases of pregnant women bearing normal weight

Estimated Fetal Weight (EFW)	Leopold's Maneuvers	Ultrasonic Measurements	Significance (P-value)
Absolute error [g]	109.52±380.29	4.93±72.83	0.000
Absolute error > 500 [g]	18.11	0.45	0.000
Absolute % error [g]	2.68	0.09	0.000
Absolute % error > 10%	15.4	0.25	0.000
Absolute % error > 20%	22.12	1.3	0.000

Table 3: Accuracy between weight estimations and actual birth weight in the cases of pregnant obese women

Estimated Fetal Weight (EFW)	Leopold's Maneuvers	Ultrasonic Measurements	Significance (P-value)
Absolute error > 500 [g]	19.8	1.13	0.000
Absolute % error [g]	2.32	0.28	0.41
Absolute error > 20 %	23.15	2.52	0.000
Absolute % error > 10%	15.78	0.22	0.003

Table 4: Accuracy between weight estimations and actual birth weight in the cases of underweight pregnant women

Estimated Fetal Weight (EFW)	Leopold's Maneuvers	Ultrasonic Measurements	Significance (P-value)
Absolute error [g]	349.56±587.2	11.94±88.67	0.45
Absolute error > 500 [g]	22.2	1.9	0.000
Absolute % error [g]	10.04	0.35	0.087
Absolute % error > 10%	22.2	0.02	0.000
Absolute % error > 20%	29.96	0.45	0.005

DISCUSSION

As proven in other studies done on large populations our research also reveals ultrasonography is a superior modality for the measurement of fetal weight, but the difference is more substantial in obese populations with fetal weight estimate inaccuracy increasing in overweight women.[9] Military Hospital, Islamabad, being a tertiary care hospital, accepts referral cases from all army hospitals of Pakistan belonging to all socioeconomic levels. The insufficient resources in our hospital such as ultrasound machines, the absence of such resources in the peripheries leads to major obstacles i.e., lack of training to utilize ultrasound routinely in their everyday practice.[14,15] Clinical weight estimate is used in primary health care clinics and when births are being carried out at home by health care personnel.

Cultural views in many cultures prefer home care when people give birth at home; they may be close to their family members and can go through the process of labour without any anxiety.[16-20] Our research demonstrates that ultrasound has a superior accuracy in fetal weight assessment than Leopold's procedures in pregnant women who are overweight however in women bearing normal weight there is minor difference between two favoring ultrasounds.

One tertiary care obstetric unit was targeted for data collection which may not be representative of huge population managed at different public and private sector rural and urban healthcare units, data collection from multiple obstetric settings in future studies may generate results which could be representative of local population.

CONCLUSION

Our study shows that ultrasound has better accuracy in fetal weight estimation than Leopold's manoeuvres in overweight pregnant women whereas in normal weight women there is slight difference between two favouring ultrasound.

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Author's Contribution

AY conceived the idea, collected the data and analyse the data and drafted the manuscript for final approval. RA, FT, LM, SF and ST Contributed in data collection and writing of the manuscript. Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

Authors declared no conflict of interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.