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ACCURACY OF ULTRASOUND ESTIMATED FETAL WEIGHT AT TERM

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Abstract:

Fetal weight estimation looks essential significance around the judgment-building procedure for obstetric preparation as well as administration. The research is contradictory about the reliability of proportions along with either sonography or clinical assessment, referred as "Leopold's maneuvers", shortly before term. Maternal Body Mass Index can be described as a confounding element as it is often linked with each fetal weight and additionally, the reliability of fetal weight evaluation.

The intent being our research ended up being to evaluate the precision of fetal weight evaluation carried out with sonography as well as with clinical examination with respect to Body Mass Index. As part of this particular potential blinded observational research, we examined the precision of clinical evaluation as in comparison towards sonography measurement in fetal weight evaluation, using the real birth weight as the gold criterion. As part of a cohort of all successive individuals which presented in the outpatient section to enroll for the delivery with ≥37 weeks, evaluation ended up being complete through ultrasound and Leopold's maneuvers in order to approximate fetal weight. Almost all assessors (midwives as well as medical professionals) experienced concerning the equivalent degree of certified experience. The biggest objective ended up being in order to evaluate general genuine mistake, overall absolute percent error, absolute percent error > ten percent, as well as absolute percent error > 20 percent for weight evaluation through ultrasound as well as through means of Leopold's manoeuvres compared to the authentic birth weight as the, offered gold criterion, namely separately for normal weight as well as for the overweight pregnant females.

Five hundred forty-three patients had been incorporated into data research. The precision of fetal weight evaluation had been considerably much better with ultrasound compared to using Leopold's maneuvers in all genuine error computations manufactured in overweight pregnant women. For each error computations carried out in average weight pregnant women, virtually no statistically important variation had been observed as part of the precision of fetal weight evaluation in between ultrasound as well as Leopold's maneuvers.

Information coming from our potential blinded observational research demonstrate a considerably improved precision of ultrasound for fetal weight evaluation in overweight pregnant females exclusively as compared in order to Leopold's maneuvers with an immense distinction in genuine error. We managed to do not notice considerably improved precision of ultrasound when reviewed in order to Leopold's maneuvers in average weight women. The additional investigation looks necessary to evaluate the circumstances in normal weight females.

Keywords: *Estimated fetal weight; Ultrasound; BMI; Clinical examination, Prospective blinded observational study.*

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INTRODUCTION:

The precision of fetal weight evaluation has a crucial significance in antenatal treatment, and to ensure the administration and planning of delivery mode and labor. In order to really accomplish additional valid prenatal fetal weight estimations as well as line up most of these risk-optimizing delivery modes, alternative approaches assisting the usage standard along with sonography tend to be required. The foremost ultrasonic approaches would always determine the weight of a fetus tend to be established on measuring of fetal AC (abdominal circumference) as well as EFW (estimated fetal weight) by employing a formulation initial explained by the most famous researcher names Hadlock et al., as well as the adequate precision of the recently approved version (Ben-Haroush et al., 2003).

Antenatal MRI (magnetic resonance imaging) or soft-tissue specifications happen to be revealed to generally be of no advantages in enhancing the reliability of fetal weight evaluation. Leopold's techniques come with a tradition that is long-standing obstetrics and midwifery and comprises initial defined because of the German gynecologist Christian Gerhard Leopold (1846–1911). The examiner can describe the position of the fetus as well as the level of the uterine fundus and thus detect a disproportion between the fetus and the female pelvis by placing both hands on the woman's abdomen. Practiced examiners have the ability to offer a medical estimate of fetal pounds after carrying out Leopold's techniques like height that is symphysis-fundal stomach palpation (Himes and Haragan, 2017).

It is observed through the Maternal Body Mass Index the accuracy of EFW effect. Medical physicians must be aware of sonographic fetal weight estimation limitation, specifically in high weight females; it also needs to observe that maternal body mass index effects ultrasonic fetal weight estimation delivery, prior to a given schedule, and the deviation measurement is higher in a pregnant female with a BMI ≥ 25. It is also analyzed that clinical analysis considers an alternative while sonography is not in reach or may determine as beneficial supplemental examination in the use of the actual weight of birth as prescribed gold standard. The basic objective of this observational research was to assess the fetal weight estimation accuracy with clinical examination and ultrasound for overweight and normal weight pregnant females.

MATERIAL AND METHODS:

Study Population:

According to given circumstances and for this specific blinded analytical research, we assessed the clinical Leopold's maneuvers accuracy with the comparison of ultrasonic measurement in the estimation of fetal weight, specifying the actual birth weight rate as the gold standard. This study if the prospective blinded assessment of all consecutive pregnant ladies, including breech and vertex, singleton gestation who are admitted for ≥37 weeks of labor.

For good performance and avoiding the biases in the selection, we analyzed those females' registration carrying ≥37 weeks. No pre-term deliveries before 37 weeks are performed in our hospital, but on the other hand, send antenatally to a specific secondary center. It is then obvious that there are not pre-term deliveries data remains in our data-set. Spontaneous labor and labor induction cases have been included and planned (given status as primary) and unmanaged (given status as secondary) cesarean sections, explained in details in Table 1 below. There were no fetal abnormalities were analyzed in all females. Systematic resources have been used to document all results either in between the method or after that. Data, strictly, maintained in an anonymized format and we did not alter the pre-existing routine examination. In the hospital, the care standard further consisted of delivery based on 37 weeks after the pregnancy.

Table 1 Patient characteristics

	n = 543	%
Maternal Age	29.2 ± 5.0	
Primiparous	269	49.5
Multiparous	274	50.5
Mean gestational age at examination [Weeks ± SD in days]	37 + 3/7 (262 d) ± 6.8d	
Mean gestational age at time of delivery [weeks ± SD in days]	39 + 2/7 (275 d) ± 8d	
Mean actual birth weight [g]	3382.9 ± 400.2	
Median time estimation to birth [in days ± SD]	15.6 ± 8	
Mode of delivery		
Spontaneous vaginal delivery	342	63.0
Operative vaginal delivery	45	8.3
Caesarean section	156 (100%)	28.7
Planned/Primary	57 (36.5%)	10.5
Unplanned/Secondary (including failed induction of labour)	99 (63.5%)	18.2
Mean maternal BMI [kg/m^2]	23.9 ± 4.8	
BMI < 25	379	69.8
BMI 25–99	164	30.2
Spontaneous onset of labour	429	79.0
Induced onset of labour	114	21.0
Gestational diabetes	29	5.3
Pre-existing diabetes	2	0.4
Chronic or gestational hypertension	9	1.7
Preeclampsia	13	2.4

Inclusion Criteria:

1.) The main source of the patient's history was their midwives

2.) CTG (Cardiotocography), approximately for 30 min in pregnant women considers a risk;

3) The primary abdominal and obstetric vaginal examination has been confirmed prior

4) There must be Ultrasound biometric measurements of the fetus by a qualified physician

5) With physician, there was a pre-delivery discussion about the potential risks and mode of delivery

In the process, we deliberately did not adjust the preexisting examination routines, as well as the midwives previously, established Leopold's maneuvers as a non-invasive analysis for the estimation of fetal weight earlier the research has been started.

The consent about the required information has been delivered to all women and recorded properly in their prescribed records. Maternal demographics and the details of pregnancy and neonatal result information further extracted from the patient's medical records. Specifically, for extrapolation of EFW about the analysis of the registration and date of birth as compared to the factual date of birth, we analyzed the percentile complementary curve for Pakistani population, specifically separated for boys and girls.

BMI was assessed specifically for the effects on fetal weight clinical estimation. Maternal BMI was

measured from self-reported height and measured weight at the registration time and further sub-divided in < 25 kg/m2 and ≥ 25 kg/m2. Gestational age at admission regarding delivery was assessed in intervals of 37 to 39 6/7 weeks, 40 to 40 6/7 weeks, and ≥ 41 weeks respectively.

Statistical Analysis:

Founding features of this research were based on descriptive statistics. Standard deviation and mean have been calculated for maternal age (years), pregnancy duration (weeks + 6/7 days), at birth time fetal weight (grams), BMI (body mass index) (kg/m2), mode of delivery, parity, labor induction as well as risk factor of maternal (gestational diabetes, preeclampsia, hypertension) specifically regarding univariate descriptive assessment. According to the absolute value of variation between observed weight and estimate, absolute errors throughout the estimation has been measured and calculated. It practically observed to report the proportion of the cases as an absolute error of ≥ 500 g.

Above analysis has been conducted regarding the normal weight as well as for overweight pregnant women. For the BMI effects investigation on estimation errors, we carried out another descriptive assessment, as mentioned in earlier, apart for the two female groups. We stratified the output for Body Mass Index for < 25 kg/m2 (normal weight) and ≥ 25 kg/m2 (overweight).

RESULTS:

Characteristics of Patients:

Total 547 pregnant female was entitled to according to our prescribed inclusion criteria, 4 pregnant women were excluded due as they gave birth on some other institutes, though their registration has been done in this institute. Consequently, the remaining 543 pregnant females had been according to our prescribed criteria and in the list of our data analysis. There 5.3% of women revealed gestational diabetes. As per the compulsory screening test of gestational diabetes in pregnancy in Pakistan as well as minutely understanding after the entitlement for delivery at our institute, that probably shows a specific different situation as compared with some other countries in Asia, it was possible for use to imperial which these 5.3% pregnant women with gestational diabetes for our research which had been extensively followed and monitored with the testing of blood sugar. As per the general outputs in overall 29 patients, who basically either on insulin or on diet, gestational diabetes pregnancies in this research had been comparable to normal pregnancies, details are in Table One as mentioned above.

There is no statistically significant variance has been observed the fetal weight estimation accuracy using Leopold's maneuvers versus sonography, consequently in utter error measurements of normal weight women deliveries, as mentioned in Table two below:

Table 2 Accuracy of both weight estimations regarding effective birth weight in all normal weight pregnant women

EFW	Leopold's manoeuvres	Ultrasound	*p* value
Absolute error [g]	279 ± 225	257 ± 204	0.0696[a]
Absolute error > 500g [%]	17.2	12.9	0.0805[b]
Absolute % error [g]	8.6 ± 7.5	7.9 ± 6.5	0.051[a]
Absolute % error > 10% [%]	33.5	29.6	0.155[b]
Absolute % error > 20% [%]	7.1	6.9	1.0[b]

There is a statistically significant variance in the fetal weight estimation accuracy has been analyzed in specific sonographic favor in all utter error determinations which carried out in overweight women delivery, as mentioned in Table Three below:

Table 3 Accuracy of both weight estimations regarding actual birth weight in all overweight pregnant women

EFW	Leopold's manoeuvres	Ultrasound	*p* value
Absolute error [g]	343 ± 250	245 ± 190	<0.001[a]
Absolute error > 500g [%]	22.6	9.1	0.0002[b]
Absolute % error [g]	10.1 ± 7.8	7.3 ± 6.1	<0.001[a]
Absolute % error > 10% [%]	42.1	24.4	0.0002[b]
Absolute % error > 20% [%]	12.8	4.3	0.0026[b]

According to Table four, there is a statistically significant variation revealed in the accuracy of fetal weight determination which is definitely in favor of sonographic and overall absolute error calculations carried out in overall women deliveries.

Table 4 Accuracy of both weight estimations regarding actual birth weight in all pregnant women

EFW	Leopold's manoeuvres	Ultrasound	*p* value
Absolute error [g]	298 ± 235	254 ± 200	<0.001[a]
Absolute error > 500g [%]	18.8	11.8	0.0003[b]
Absolute % error [g]	9.1 ± 7.6	7.7 ± 6.4	<0.001[a]
Absolute % error > 10% [%]	36.1	28.0	0.0004[b]
Absolute % error > 20% [%]	8.8	6.1	0.036[b]

The density of distribution of estimated fetal weight as compared to actual birth weight established by ultrasound versus palpation is shown in Fig. 1. The data in the present study show that the estimates made by the examiners, whether physicians or midwives, whether with ultrasound or clinical palpation, were close together in normal weight women.

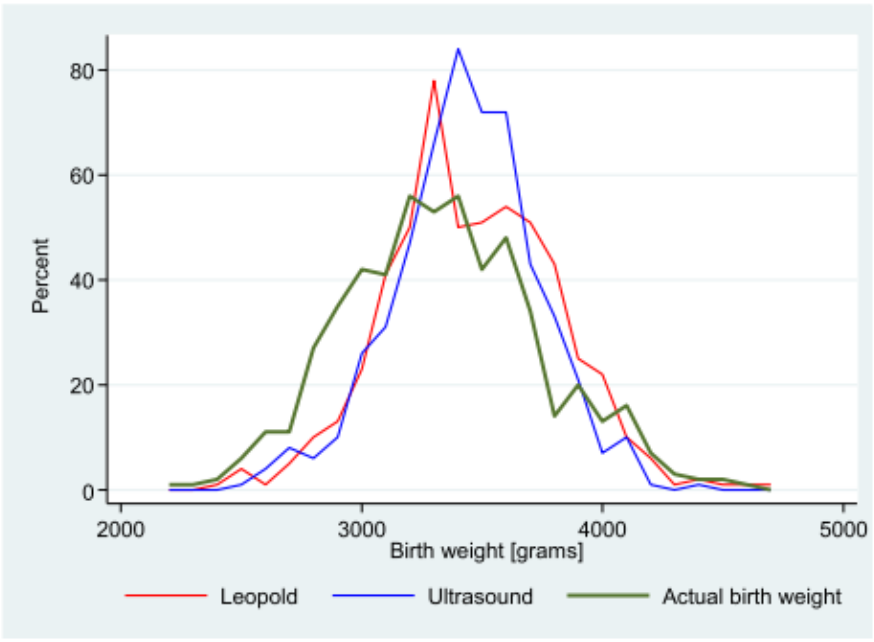

Fig. 1 Estimated fetal weight from the time of examination in relation to the actual birth weight

Fetal weight estimations of normal weight and overweight women with Leopold's maneuvers or ultrasound displaying absolute error, absolute error > 500 g, absolute percent error, absolute error > 10% and absolute error > 20%, including 95% confidence intervals (± 95% CI) are shown in detail in Fig. 2, a – e)

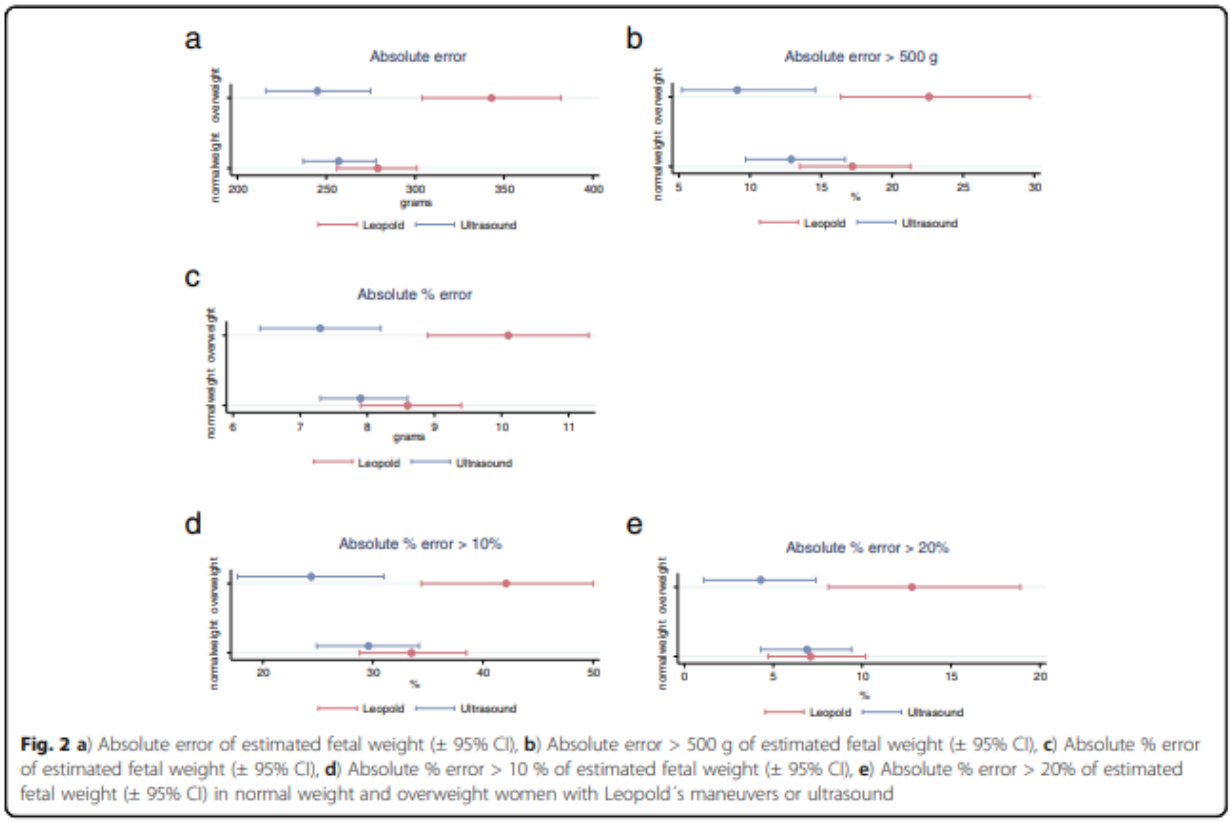

Fig. 2 a) Absolute error of estimated fetal weight (± 95% CI), **b**) Absolute error > 500 g of estimated fetal weight (± 95% CI), **c**) Absolute % error of estimated fetal weight (± 95% CI), **d**) Absolute % error > 10 % of estimated fetal weight (± 95% CI), **e**) Absolute % error > 20% of estimated fetal weight (± 95% CI) in normal weight and overweight women with Leopold´s maneuvers or ultrasound

DISCUSSION:

We deliberately found a statistically significant variation of fetal weight estimation accuracy, which is in favor of sonography in all absolute error determinations carried out in obsessed women giving birth in this blinded observational research. However, there are no statistically significant variations in normal weight women deliveries. According to the delivery and exact timing mode in the event which is basically required to stimulate labor, fetal weight determination accuracy is of core significance in obstetrician's decision-making procedure shared with the expectant mother and has been a matter of consideration regarding several years. A deviation of 500 grams may specify an important effect on the process of shared decision and specifically with regard to cut-off levels given in international guidelines (Lynch et al., 2010).

Firstly, with the interpretation of other evidence, this research shows a statistically significant difference in fetal weight estimation accuracy in favor of sonography in all absolute error calculations established in obsessed females giving birth. As per the absolute error > 500 gram which considered clinically pertinent specifically for this process of obstetric decision-making, there is a core variation observed in between both approaches which may utilize in obsessed pregnant women (Himes and Haragan, 2017).

Second, no statistically significant difference was seen in the accuracy of fetal weight estimation obtained with Leopold's maneuvers versus ultrasound in absolute error calculations performed in normal weight women giving birth. The most established way to estimate the fetal weight is the ultrasound method, as previously described and most commonly performed with three measurements fitted into an algorithm designed by Hadlock et al. Other approaches like MRI or soft-tissue measurements have proved to not be of added benefit. International percentile curves for EFW, calculated after studies of fetuses in Asian countries and used to check the week-adapted weight of the unborn fetuses worldwide, may not be the right strategy because they pursue a one-size-fits-all policy in approaching what is too large or too small. Very recently Nicolaides et al. published a study aiming to develop fetal and neonatal population weight charts. The rationale was that reference ranges of EFW are representative for the whole population, while the traditional approach of deriving birth-weight (BW) charts is misleading because a large proportion

of babies born preterm arise from pathological pregnancy (Khan et al., 2015).

This research authorized that the requirement of the unique and single international standard for all countries is not appropriate. This has been demonstrated in different studies before by likely differences in percentile curves as a consequence of underlying differences in the study populations. The long-standing, mainly midwifery-based tradition of clinical weight estimation by means of Leopold's maneuvers is a non-invasive approach to fetal weight estimation that is used when ultrasound is not available (Malhotra and Jain, 2016).

Several prospective studies were able to show advantages of clinical palpation like Leopold's maneuvers in predicting fetal macrosomia, and the accuracy of fetal weight estimation when using ultrasound biometry has been shown to be no better than that of Leopold's maneuvers. Still, other studies report an advantage for them for fetal weight estimation (Maaji, 2015).

CONCLUSION:

According to the mentioned above details in this prospective blinded research, it is observed that ultrasound have an important level of accuracy in the estimation of fetal weight, specifically in overweight pregnant female as compared with Leopold's maneuvers. Therefore, this is no statistically significant variation in between both approaches which were analyzed in normal weight ladies. The clinical approach utilizing Leopold's maneuvers may be beneficial in those countries which have poor infrastructure and mostly have no facility to use ultrasonic devices.

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