Original Article

Correlation of Ultrasound (Hadlock Method) in Estimating Antepartum Fetal Weight Keeping Actual Weight at Birth as Gold Standard

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Abstract

Objective: To determine the link between ultrasonography and antepartum fetal weight, keeping the actual weight at birth as the gold standard.

Methodology: This cross-sectional validation study was conducted at dept. of Radiology, KRL Hospital Islamabad from January 1st, 2020 until July 1st 2020. Non-probability convenient sampling was used to choose and analyze 64 patients. A consultant radiologist used a Logic P/6 3D equipment to perform ultrasounds. The fetal biometry by hadlock method (BPD, HC, AC and FL) and cumulative estimated fetal birth weight by ultrasonography were computed at 37 weeks and data was collected on the attached performa. At the time of delivery, the newborn's exact weight was recorded. The SPSS software (version 17.0), was used to analyze the data, and the results were interpreted using descriptive and inferential statistics. A paired sample t-test was used to examine the significance of the mean difference between birth weights and USG measurements (both unadjusted and adjusted).

Results: At a mean gestational age of 37 weeks, with a standard deviation of 1.2 weeks. The study included a sample size of 64 pregnant women who presented to the department of radiology. According to ultrasound estimates, the fetus average weighed 3006.9+/-292 grams, and the outcome birth weighed average 3000.5+/-305 grams after birth. Hence, it is concluded that there is a significant positive correlation between the sonographically estimated fetal weight and the actual fetal weight.

Conclusions: We conclude that the sonographically estimated antenatal birth weight and the actual birth weight are indistinguishable, hence antenatal ultrasound can be used with confidence to determine birth weight.

Keywords: Antepartum, Estimated fetal weight, hadlock, sonography, GA(gestational age),Prenatal diagnosis, IUGR (intrauterine growth retardation) ,LGA(large for gestational age)

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Introduction

Death and disease among mothers and babies are serious issues in Pakistan.[1] Ultrasound has a critical function in predicting prenatal morbidity and its consequences. If IUGR and LGA are identified before delivery, appropriate care can be arranged, as both are associated with their own set of difficulties. IUGR is a very high risk factor for stillbirth, while LGA is associated with obstructed labour, shoulder dystocia, birth canal and pelvic floor injuries, and an increased frequency of caesarean section for babies born above the 90th percentile of their gestational age.[2]

It is imperative that the prenatal birth weight be accurately measured, as the mode and time of delivery (as well as the baby's chances of survival and NICU admittance and stay) are directly linked to the birth weight.[3] As part of standard prenatal care, it aids in

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clinician preparation for anticipated preterm delivery and decision-making regarding delivery method.[4]

Ultrasound is a useful supplement for the clinical assessment of prenatal birth weight. BPD, HC, AC & FL are among the most often used prenatal methods for calculating fetal birth weight.[5]

It is clear from published research that sonographic fetal biometry is a considerably better predictor of expected fetal birth weight than a single clinical assessment. One of the pieces that have appeared in these publications has demonstrated Predicting projected fetal weight using fetal biometry is the goal of this study, which uses the actual birth weight as a gold standard, in order to help doctor's plan for the feto-maternal outcome and take proactive measures to prevent perinatal and mother mortality.

Methodology

This cross-sectional validation study was conducted at KRL Hospital Islamabad from January 1st, 2020 to July 1st 2020. Prior to the beginning of the sonographic assessment, written informed consent was obtained from each patient, as well as ethical approval from the hospital's ethical committee. Pregnant women who came to the radiology department of KRL hospital Islamabad at term for an ultrasound were included in the study.

The Raosoft sample size calculator was used to calculate the sample size, with a confidence interval of 95%, a margin of error of 5%, and a reported prevalence of 30% antenatal check-up during that time period. 6 The estimated sample size came out to be 64 individuals. Non-probability convenient sampling was used.

Both primary gravida and multigravida antenatal scheduled patients who presented at term for ultrasonography were included in our study. There were no patients with multiple pregnancies, oligohydramnios or polyhydramnios; diabetic mellitis; pregnancy-induced hypertension; preterm labour, IUGR, preterm premature rupture of membranes; stillbirth; morbidly obese; or postdates included in the study.

A consultant radiologist used a Logic P/6 3D equipment to perform ultrasounds. The fetal biometry by hadlock method (BPD, HC, AC and FL) and cumulative estimated fetal birth weight by ultrasonography were computed at 37 weeks and data was collected on the attached performa. We tracked this patient's progress and made a note of the baby's exact birth weight. Up until the moment of birth, a daily increase of 25 grams was made.

The data was analyzed using the SPSS software (version 17.0), and descriptive and inferential statistics were utilized to interpret the results. A paired sample t-test was used to examine the significance of the mean difference between birth weights and USG measurements (both unadjusted and adjusted) along with The Pearson correlation coefficient to find a significant correlation between the two parameters. ($p<0.01$)

Results

We enrolled a total of 64 pregnant women (n=64) in this study. Table I shows the distribution of ages and gestational ages. Ultrasonography was used to determine the foetal weight, and the results were subsequently recorded after the baby was born. The standard deviation (SD) of the mean time difference between two weight assessments was 5.1 days (table I).

Table I: Descriptive statistics

Variable	Min	Max	Mean ± SD
Maternal Age (years)	21.00	36.00	27.5±3.8
Gestational age (weeks)			
At the time of USG	34.71	40.43	37.5±1.2
At delivery	34.29	40.86	37.9±1.4
Mean difference (days)	-8.00	14.00	2.9±5.1
Fetal weight (g)			
At USG (un-adjusted)	2250.00	3500.00	2921.2±301.9
At USG (adjusted)	2375.00	3650.00	3006.9±292.7
At Birth	2200.00	3600.00	3000.5±305.5

Ultrasound-measured fetal weights were added by 25 g for each day that passed. A paired sample t-test was used to examine the significance of the mean difference between birth weights and USG measurements (both unadjusted and adjusted). When weights measured by ultrasonography were not adjusted for elapsed time, the difference was statistically significant (P=0.001 in table II. After adjusting the weights, however, the difference was no longer significant (p=0.761, table II).

Table II: Comparison between fetal birth weights (paired sample t-test)

Variable	Mean	Std. Dev	P-value
Fetal weight (g)			
At Birth	3000.5	305.5	0.001
At USG (un-adjusted)	2921.2	301.9	
At Birth	3000.5	305.5	0.716
At USG (adjusted)	3006.9	292.7	

A bivariate connection was found between the fetal weight at birth and the fetal weight assessed through the USG. According to the Pearson correlation coefficient "r" (p=0.001), two weights are closely correlated with one another (table II)

When USG fetal weight measurements were adjusted for time elapsed, the association was considerably stronger. (p=0.001; table IV). The Pearson correlation coefficient was found to be 0.894% and positive

Table III: Correlation between fetal weight at birth and at USG (unadjusted)

		WEIGHT (AT BIRTH)	WEIGHT USG (UNADJUSTED)
WEIGHT (AT BIRTH)	**r**	1	.885**
	Sig. (2-tailed)		.000
	n	64	64
WEIGHT USG (UNADJUSTED)	**r**	.885**	1
	Sig. (2-tailed)	.000	
	n	64	64

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: Correlation between fetal weight at birth and at USG (adjusted)

		WEIGHT (AT BIRTH)	WEIGHT USG (ADJUSTED)
WEIGHT (AT BIRTH)	**r**	1	.894**
	Sig. (2-tailed)		.000
	n	64	64
WEIGHT USG (UNADJUSTED)	**r**	.894**	1
	Sig. (2-tailed)	.000	
	n	64	64

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

In the previous few years, Pakistan's maternal and prenatal death rates have not improved.[1] These are critical measures of healthcare quality. Our country's healthcare system can be improved by utilising the latest technological advancements.[7] Important attention can be placed on risk factors such newborn low birth weight in order to perform any action.[8] It is estimated that approximately 16–17 percent of all deliveries are low birth weight (LBW), with the lowest average birth weights in Asia ranging from approximately 2700–2800 g in the Indian subcontinent. WHO presented an analogous low birth weight rate of 30–40 percent in 1979, which was later re-updated in 1982.[9]

In order to determine the foetal weight, the growth, timing, and route of birth, and to identify any abnormalities as foetal growth abnormality, ultrasound is a noninvasive approach. It is important for obstetrics management to accurately estimate the fetomaternal outcome and planned management to have an accurate antenatal estimated birth weight.[5] The standard clinical assessment and the noninvasive but more accurate sonographic foetal weight assessment are two examples of indirect methods.[10]

Both ultrasound and clinical examinations are believed to be equally accurate for estimating low birth weights, but ultrasonography is considered to be more precise.[11]

According to the results of one prospective investigation, the Hadlock approach is more accurate at predicting birth weight than other methods. Pregnancy at full term can lead to inaccurate measurements of fetal head weight, and the Hadlock method is the most accurate method for estimating birth weights because it incorporates both the fetal head and the placenta, which are not affected by engagement or moulding, making this method ideal for determining birth weight.[12]

Sonographic measurements are based on the basic premise that the foetus' numerous linear and planar sizes provide sufficient parametric information to allow for the precise algorithmic reconstruction of three-dimensional fetal volumes with changing tissue densities.[13] As a result, we carried out this research to see how well the Hadlock method of calculating antepartum fetal weight correlates with actual birth weight.

In our work, we used hadlock for antenatal fetal weight assessment to combine several fetal biometric characteristics, such as the HC, BPD, AC, and FL. A bivariate connection was found between the fetal weight at birth and the fetal weight assessed through the USG. In this case, the Pearson correlation coefficient (r) was 0.885 (p=0.001), indicating that the two weights have a very strong positive relationship. It is possible to plan ahead for postpartum repercussions and take essential safeguards by anticipating foetal weight accurately throughout pregnancy. This can save both the mother and the foetus' lives.

Saeed Taha et al. reported an average EFW of 3187.60 g and a mean actual birth weight of 3282.32 g in another study. There was a 94.72 grams discrepancy between the averages of actual and estimated fetal birth weight. According to this study, the weight of a baby at delivery and the weight that can be determined using sonography

are highly correlated.[14] ABW (r=0.927) demonstrated a positive link with the mean estimated fetal weight of the patients, according to a study published in 2020 by Razaq et al.[15]

Small-for-gestational-age singleton births born after 36 weeks that are less than the 10th percentile for birth weight and less than the 5th percentile for gestational age were included in a retrospective analysis by k.Stephens et al. The EFW and birthweight of fetuses assessed using ultrasound within two weeks of delivery had a strong association (P .001, r = 0.73 (Pearson correlation)[16]

Compared to Leopold's procedures, an Australian prospective blinded observational study demonstrates that ultrasonography is much more accurate for estimating foetal weight in overweight pregnant women.17 Mean estimated and actual birth weights in Nigeria were shown to be indistinguishable in a 2015 study by Eze CU, et al[4]

New research out of Nigeria suggests that the sonographic method is more accurate than clinical procedures when it comes to prenatal weight estimation. It is only in low-resource contexts that clinical procedures that overestimate foetal weight are of any benefit, as a normal-weight foetus can be identified without the worry of macrosomia-related problems.[18]

Despite the study's obvious importance, numerous drawbacks exist. That's a single-center study with a single homogeneous group of participants. Secondly, the study excludes small-for-gestational-age kids, therefore it will be difficult to draw conclusions about the prevalence of low birth weight babies.

Conclusion

According to the results of our research, the ultrasound-estimated fetal weight and the actual fetal birth weight have a strong positive link. It is therefore possible to use ultrasound to accurately estimate prenatal weight and to predict perinatal complications in order to avoid and prevent them as well as plan the mode and timing of delivery as well as to alert associated disciplines, such as neonatologists, for neonatal care and management, by using ultrasound as an accurate noninvasive tool. In order to reduce maternal and perinatal mortality, all of these strategies work together, but ultrasound is unable to accurately detect fetal weight and can only fairly estimate it with statistically acceptable variation.

Ultrasound machines are becoming an integral part of modern obstetrics practice. It is, however, dependent on the machine's performance as well as the expertise of the sonographer

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