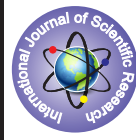


A Comparative Study of Fetal Weight Estimation Using Ultrasound and Johnson's Formula and its Correlation with Actual Birth Weight



Medical Science

KEYWORDS : Johnson's formula, estimated fetal weight, real time ultrasound scanner, Hadlock's formula, symphysio-fundal height

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ABSTRACT

Introduction: During the last two decades, estimated fetal weight has been incorporated into the standard routine antepartum evaluation of high risk pregnancies and deliveries. A fetus or newborn infant whose weight is appreciably above or below normal is at increased risk of physical and intellectual impairment. **Objectives:** To estimate sensitivity and specificity of birth weight determined by ultrasound and by Johnson's formula with actual birth weight in birth weight estimation. **MATERIALS AND METHODS :** A prospective comparative study was conducted on 180 women booked at Mamata General Hospital,khammam between 38-40 weeks of gestation and in early labour in the same gestational period in whom ultrasound was done during last one week before delivery ; the ultrasound and Johnson's formula were correlated. **RESULTS :** Comparing both the methods, ultrasound was found to be more accurate in the range of 2500-3500g. The sensitivity and specificity , positive predictive value, negative predictive value of Johnson's formula in the present study were 86.4%,59.3%,90.7%,48.7% respectively and ultrasound estimation of fetal weight were 93.1%, 71.8%,93.9%,71.8%.in all aspects ultrasound was superior to clinical method of fetal weight estimation. **CONCLUSION :** Ultrasound estimation of fetal weight is better reliable method than Johnson's formula wherever facilities are available. It can be used in breech and other malpresentations where Johnson's formula cannot be applied. It has high sensitivity and specificity to estimate fetal weight and correlates significantly with actual birth weight.

Introduction

Clinical estimation of fetal weight using abdominal palpation has been shown to be within 500gms in 85% of the cases, with more accuracy in the average, term fetus than in preterm or macrosomic fetus. Assessment of fetal weight in utero leads to improved prospective management of high risk pregnancy, Vaginal birth after cesarean section , IUGR and intrapartum management of breech , anticipated preterm delivery , perinatal counseling, optimal route of delivery and place where delivery were based by estimation of expected birth weight .

Accurate methods of estimated fetal weight in Utero includes clinical,radiological and ultrasonography, radiography is now abandoned because of its hazards to both fetus and mother .

Dare et al used the product of symphysio fundal height and abdominal girth at the level of umbilicus measured in centimeters and result expressed in grams to estimate fetal weight in utero .Johnsons formula is also used for clinical estimation of birth weight .

Recently ultrasonography has gained popularity for determination of fetal parameters, fetal well being ,estimation of fetal weight and location of placenta

MRI recently been used for estimating fetal volume and weight , its disadvantage is its expensive .

Clinical methods are very useful and important in a country like India because sophisticated instrument like ultrasound is not available everywhere . Hence efficiency of Johnsons formula and ultrasound assessment with regard to fetal weight as well as correlation between two values obtained are compared in this study

Material and methods

This study was conducted in 180 pregnant women who were booked at mamata general hospital between 38-40 weeks and early labour in same gestational period in whom ultrasound was done during last one week before delivery were included in the study . On clinical examination all had vertex presentation but otherwise no selection was made as regards to age, parity , height, weight , presence or absence of membranes .Patients associated with diseases such as anaemia, hypertensive disorders of pregnancy , gestational diabetes and heart disease were

included in the study

After general examination, obstetric examination was done to determine presentation and position of fetus, position of Fetal heart rate noted followed by vaginal examination . malpresentation were excluded from the study . Women emptied her bladder before examination ,measurement of gravid uterus was taken in dorsal position with knee and hip semiflexed . vertical height of uterus from middle of upper border of symphysis pubis to highest point on fundus was measured using flexible tape in centimeters

Clinical estimation of fetal weight was estimated using Johnsons formula

$W(g) = (SFH - X) \times 155$ where W= weight in grams

SFH = symphysio fundal height in centimeters

X=12 if station is at or above the level of spines

X=11 if station is below the level of spines

All the patients were subjected to ultrasonography . in our hospital we use real time ultrasound scanner linear probe 4 MHz . Ultrasound was done using Hadlocks formula – $\log_{10} EFW = 1.3598 + 0.051(AC) + 0.1844(FL) - 0.0037(AC \times FL)$

Where EFW is estimated fetal weight , AC- abdominal circumference and FL – femur length

After birth, baby was weighed using infantometer

Statistical methods were used in this study. They were : Frequencies, chi-square , descriptive, crosstabs,pearsons correlation coefficient , one way ANOVA

RESULTS:

In the study all the cases were between 18-40years of age , most of the cases were between 20- 24 years of age comprising 52 % (94)of the total number of cases included in this study . Maximum number of cases was those of primipara 45% (81)of the total . 87.8% of the cases belonged to low socioeconomic status . 95%(172) cases were more than 145cms tall . 151 patients did not have any associated disease. Abnormal OGCT in 7 patients,

9 cases of preeclampsia, one case each of asthma, mitral regurgitation and gestational diabetes. 31% had FTV, 42% emergency LSCS, 22% elective LSCS and 3% outlet forceps delivery.

Primigravida constituted 67%(55) patients had baby weighing in the range of 2501-3500 gms. One baby each of the women who were 3rd and 4th gravid patients were in the birth weight range of 1501-2000gms. 76%(138) babies were in birth weight range of 2500-3500 grams.

Sensitivity of Johnsons formula is 86% and specificity 59%, sensitivity of Ultrasonography method 93% and specificity is 71%. While comparing clinical and USG method to determine fetal weight, sensitivity and specificity of USG method is better than the clinical method. We can infer that ultrasound derived EFW significantly correlates to actual birth weight better than clinical method.

Discussion

180 cases were included in this study, it included the women who were primigravida upto 5th gravid. They delivered within 7 days of the ultrasound being done. The present study included all the cases with vertex presentation and women with gestational age of 38-40 weeks and both primigravida as well as multigravida about 5% cases of anaemia, 3% of abnormal OGCT, 5% cases of preeclampsia. Therefore according to the present study, ultrasound estimation significantly correlated to actual birth weight than the clinical method.

The study of Benacerraf et al had as sensitivity of 65% and specificity of 90% when EFW of 4000g and more. But the present study had more sensitivity of 93% and lesser sensitivity of 71% when used for birth weight 3500 g.

In the present study, 28% of the cases estimated by clinical method were within $\pm 5\%$ error. However it was 46.1% for ultrasound estimation of fetal weight. A total number of 13% cases were estimated more than $\pm 15\%$ actual birth weight USG where as it was 32% cases for clinical method. Ultrasound estimation is more accurate when errors were less than 500grams when compared to the clinical method.

Conclusion

Using Johnsons formula, 47% cases were estimated within $\pm 10\%$ of actual birth weight. When there was oligohydramnios and polyhydramnios, weight was over estimated but when the liquor was adequate, maternal obesity too was a fallacy in overestimating the fetal weight. Johnsons formula was found to be the least accurate when actual birth weight was <2500g and there was increased accuracy in the weight range of 2500-3500 grams and Sex of baby did not have any significant influence on fetal weight estimation.

The sensitivity, specificity, positive predictive value, negative predictive value of ultrasound estimation of fetal weight in the present study were 93%, 71%, 93%, 71% and Johnsons formula were - 86%, 59%, 90%, 48%.

The results were more accurate when actual birth weight was in the range of 2500-3500g. In all aspects ultrasound was superior to clinical methods of fetal weight estimation. The estimation of fetal weight by ultrasound correlated significantly with actual birth weight than clinical estimation.

TABLE-1 AGE WISE DISTRIBUTION

Age group(years)	Number of cases	Percentage
Below 19	19	11.7
20-24	94	52.2
25-29	55	29.4
30-34	8	4.4
More than 35	4	2.2
Total	180	100

TABLE-2 DISTRIBUTION OF CASES WITH RESPECT TO PARITY.

Gravida	Number of cases	Percentage
Primi	81	45
2 nd gravid	62	34.4
3 rd gravid	30	16.7
4 th gravid	6	3.3
5 th gravid	1	0.6
Total	180	100

TABLE-3 CUMULATIVE PERCENTAGE ERRORS CALCULATED IN USG METHOD

Error	Number of cases	Percentage
$\pm 5\%$	83	46.1
$\pm 10\%$	126	70
$\pm 15\%$	155	86.1
>15%	25	13.9

TABLE-4 CUMULATIVE PERCENTAGE ERRORS CALCULATED IN CLINICAL METHOD

Error	Number of cases	Percentage
$\pm 5\%$	51	28.3
$\pm 10\%$	86	47.7
$\pm 15\%$	122	67.7
>15%	58	32.3

TABLE-5 COMPARATIVE STUDIES OF CORRELATION

Study	Year	USG	CLINICAL
Gerard et al	2003	0.44-0.79	0.6
Ben-Haroush A et al	2004	0.775	
George noumi et al	2005	0.65	0.59
Present study	2011	0.58	0.496

TABLE-6 CORRELATION

	Johnson's	USG	Actual birth weight
Johnson's	1.000	0.329*	0.496*
USG	0.329*	1.000	0.589*
Actual birth weight	0.496*	0.589*	1.000

*correlation is significant

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