Original Research Paper

Volume-9 | Issue-5 | May-2019 | PRINT ISSN No 2249 - 555X

Obstetrics & Gynaecology

ROLE OF FETAL THIGH CIRCUMFERENCE IN ESTIMATION OF BIRTH WEIGHT BY ULTRASOUND

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KEYWORDS :

INTRODUCTION

The introduction of sonography by Ian Donald and collegues in 1958 is regarded as one of the major mile stone of modern medicine. In present day obstetrics with increasing use of ultrasound there is a rapid decline in maternal and perinatal mortality and morbidity. Assessment of fetal weight in utero leads to improved management of high risk pregnancies.

Various ultrasound parameters were used for estimating fetal weight:
a) To improve the accuracy, multiple parameters like biparietal diameter, abdominal circumference, femur length & thigh circumference have been used for estimating fetal weight.

Because the fetal weight depends not only on head and body dimensions but also on extremity dimensions it is reasonable to investigate the role of thigh circumference measurement in improving fetal weight estimates.

Formulae incorporating thigh circumference measurement may be proven most useful in predicting fetal weight when growth abnormalities are present. Paediatric experience has shown that thigh circumference is one of the parameters that reflects soft tissue mass.

AIMS & OBJECTIVES

- To evaluate the role of fetal thigh circumference measurement by ultrasound in prediction of estimated fetal weight and its contribution along with other measurement in predicting the fetal weight.
- To evaluate fetal weight estimates by clinical and ultrasonic methods.

MATERIALS AND METHODS

1. Study Design – Prospective study in the year 2012
2. Inclusion Criteria – Singleton antenatal mothers at or near term.
3. Exclusion Criteria – Multiple pregnancies
- Complicated by Medical conditions like diabetes, cardiac disorders, SLE, Chronic renal diseases
- Congenital Anomalies.

4. Sample Population : 110 patients who attended antenatal clinic or RMMCH, Chidambaram. All patients were examined at or near term. All patients delivered within 3 days of estimating the fetal weight. A detailed history is elicited from all the patients. At the same time patient fundal height is measured for calculating johnson's formula. Fetal weight in gms = (fundal height in cms – n) x k

Ultrasonic measurement are made with linear array real time ultrasound machine (ultra mark 4 plus) equipped with a 3.5 MHz transducer. Ultrasound measurements of BPD, FL, AC and thigh circumference were done.

MEASUREMENT OF THIGH CIRCUMFERENCE

Transducer is rotated to 90 to obtain a cross sectional profile of the middle of the thigh at a position that the bone profile was as round as possible and the boundary of the thigh profile well defined.

Circumference is determined with the formula (D_1+D_2) x 1.57 on the basis of diameter at right angle to each other.

Equation which includes
BPD, AC, FL, THC.
Log10 (BW) = 1.87+0.015 x AC+0.057xBPD+0.054 x FL+0.011(THC) -VINTZILEOS et.al

Estimated fetal weight by SFH x AG, Johnson formula, formula which includes BPD, AC, FL, Vintzileo's formula which includes thigh circumference along with BPD, FL, AC are compared with actual birth weight.

- Within half an hour of delivery neonates were weighed on weighing scale and actual weight of the neonate was compared with clinical and ultra sound estimated fetal weight.
- Thigh circumference of the neonate is measured at the middle of the thigh using measuring tape in 50 cases. This is compared with ultrasonically measured thigh circumference.

RESULTS AND ANALYSIS

TABLE I : DISTRIBUTION OF PARITY

Parity	Number (N=110)	Percentage (%)
Primigravida	60	54.55
Multigravida	50	45.45

As shown in Table I of all patients analyzed, 54.55% were primigravida and 45.45% were multigravida.

TABLE II : DISTRIBUTION OF WEIGHT GROUP

Group	Number (N=110)	Percentage (%)
Group I < 2500 gms	39	36
Group II 2501-3000 gms	33	30
Group III 3001-3500 gms	30	27
Group IV > 3500 gms	8	7

Table II shows how 110 cases under the present study have been categorized into 4 groups and number of cases in each group.

TABLE III : MEAN AND STANDARD DEVIATION IN OVERALL WEIGHT GROUPS (N=110)

	MEAN	SD
Actual Birth Weight	2822	538
SFH x AG	3199	651
Johnson's method	3227	593
Hadlock	3013	543
Vintzileos	2711	529

Mean birth weight for all the 110 patients studied was 2820 gms and the mean gestational age was 38.2 weeks. In overall 110 cases Vintzileos formula is closest to actual birth weight.

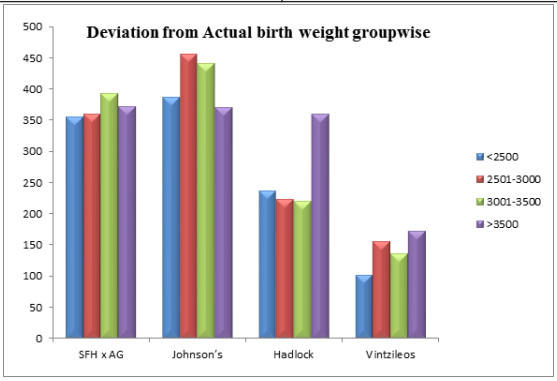
TABLE IV : DEVIATION FROM ACTUAL BIRTH WEIGHTS GROUPWISE

Weight group	<2500	2501-3000	3001-3500	>3500
Number	N=39	N=33	N=30	N=8
SFH x AG	+356	+360	+394	+373
Johnson's	+388	+456	+441	+371
Hadlock	+237	+223	+220	+360
Vintzileos	+101	+156	+136	+173

In all the weight groups Vintzileos formula is more accurate in predicting the actual birth weight than Hadlock, SFH x AG & Johnson formula.

AVERAGE OF THIGH CIRCUMFERENCE FL/TC

Prenatal (by Usg) cms	Post natal (actual) cms
12-14	12.8 – 13.8



DISCUSSION

The mean of actual birth weight in the study by Anthony M.Vintzileos et al [1,2] was 2328 gms and the mean gestational age 34.9 wks.

In this study means of actual birth weight is 2822 gms and mean gestational age 38.2 wks.

In the study by Vintzileos et al (1987), percentage of cases with estimated fetal weight within ±5% and ±10% of actual birth weight by including thigh circumference was 32.9 and 76.3% respectively. With formula which included BPD, AC and FL percentage of cases predicted within ±5 to 10% was 42.1 and 75.0.

In this study by **Vintzileos et al** in weight groups 1500-2500 gms model incorporating thigh circumference showed under estimation. In this study also in weight group <2500 gms, formula including thigh circumference showed under estimation.

In the study by Vintzileos et al in weight groups >2500 gms model incorporating THC showed underestimation. In this study also in weight group >2500 gms, formula including thigh circumference showed underestimation.

In weight group 2501 – 3000 gms formula including Vintzileos formula is comparable to Hadlock formula [3,4]. In all other weight groups Vintzileos formula is better than Hadlock formula.

In weight group > 3500 gms Vintzileos, Hadlock, Johnson and SGH x AG are comparable. This might be due to small sample size.

THC is comparable to BPD and AC as per evaluation of measurement errors by Deter et al [5] in 1982.

Our group of study has also shown that decrease in THC is seen in IUGR babies. And THC formulas can be helpful in improving the accuracy of fetal weight estimates in IUGR. The specificity and sensitivity in predicting IUGR is about 50% and it is higher than 44% as per the studies of Hill et al [6] in 1986. Hughey [7] (1970) was able to detect only 23% of SGA foetus by clinical means and selective ultra sounds.

Results using cephalometry was disappointed but the study of Campbell et al.[8] in 1974 and Deter et.al [9] in 1982 showed that fetal abdominometry correlated well with fetal growth.

In this study there was a good correlation between prenatal and postnatal thigh circumference estimates and ultrasound can fairly reproduce the actual thigh circumference.

CONCLUSION

Inclusion of thigh circumference improved the accuracy of fetal weight estimation by ultra sound.

- Vintzileos formula which included BPD, AC, FL, and thigh circumference is more accurate than Hadlock formula which included only BPD, AC and FL.
- Hadlock formula is comparable to Vintzileos formula in weight group 2501-3000 gms
- Estimate of fetal weight clinically has a significant margin of error.
- Good correlation was found between prenatal and postnatal thigh circumference estimates & ultrasound can fairly reproduce the actual thigh circumference and its inclusion in routine ultrasound is strongly recommended to improve the birth estimates.

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