J Obstet Gynecol Ind Vol. 54, No. 4 : July/August 2004 Pg 336-339

Comparative Study of Various Methods of Fetal Weight Estimation at Term Pregnancy

Bhandary *Amritha A*, Pinto *Patric J*, Shetty *Ashwin P*
Department of Obstetrics and Gynecology, Kasturba Medical College, Mangalore.

OBJECTIVE – To make a comparative evaluation of estimation of fetal weight in term pregnancy by using a) abdominal girth (AG) X symphysiofundal height (SFH) b) Hadlock's formula using ultrasonography c) Johnson's formula and d) Dawn's formula. **METHODS** – The fetal weight in-utero was calculated by using the above methods in 200 pregnant women at term. The results were correlated with the actual birth weight. Comparative analysis of the accuracy of the various methods was done. **RESULTS** – Average error in fetal weight estimation was least with AG X SFH method. Maximum error in fetal weight calculation was most marked with Dawn's formula and least with AG X SFH. 85.5% of cases came within 15% of birth weight by both AG X SFH method and Hadlock's formula using ultrasonography. Standard deviation of prediction error was least with Hadlock's ultrasound method, closely followed by AG X SFH method. **CONCLUSION** – Though ultrasound predicts the fetal weight more accurately, AG X SFH which is also equally good should be used in day to day practice, especially in places where ultrasound is not available.

Key words : abdominal girth, symphysiofundal height, fetal weight, birth weight

Introduction

Knowledge of the weight of the fetus in-utero is important for the obstetrician to decide whether to deliver or not to deliver the fetus and also to decide on the mode of delivery. Estimation of fetal weight is being done clinically, which has been criticized as less accurate because of observer variations. But Sherman et al[1], Baum et al[2] and Titapant et al[3] have found clinical estimation quite reliable. Ultrasound estimation of fetal weight using different formulas has gained much popularity. Various clinical formulas like Johnson's formula and Dawn's formula have come into usage for fetal weight estimation. Dare et al[4] used the product of symphysiofundal height and abdominal girth measurements in centimeters in obtaining fairly predictable fetal weight estimation.

The aim of this study was to assess the fetal weight in term pregnancies by various methods – Abdominal Girth (centimeters) X symphysiofundal height (centimeters) (AG X SFH), Johnson's formula, Dawn's formula and Hadlock's formula using ultrasound, and to do the comparative evaluation of the methods after knowing the actual birth weight of the babies.

Material and Methods

Two hundred women at term pregnancy were studied. The fetal weight was estimated within a week prior to the delivery. If the delivery did not occur within a week of the estimations, the estimations were repeated and these repeat estimations were taken into consideration. Cases of multiple gestation, malpresentation poly- or oligohydramnios and fibroids or adnexal masses were excluded from the study.

The study consisted of estimation of fetal weight using the following four methods.

1. Weight in grams – Abdominal girth (centimeters) x symphysiofundal height (centimeters) (AG X SFH). Abdominal girth was measured at the level of the umbilicus. Symphysiofundal height or Mcdonald's measurement was taken, after correcting the dextro-rotation, from the upper border of the symphysis to the height of the fundus.

2. Johnson's formula – Weight in grams = (Mcdonald's measurement of symphysiofundal height in centimeters – x) X 155. Mcdonald's measurement was done as mentioned above. Station of the head was noted.

   x= 13, when presenting part was not engaged

   x = 12, when presenting part was at 0 station

   x = 11 when presenting part was at + 1 station

3. Dawn's Formula

   $$\text{Weight (gms)} = \frac{\text{Longitudinal diameter of the uterus} \times (\text{Transverse diameter of the uterus})^2 \times 1.44}{2}$$

Paper received on 14/04/03 ; accepted on 13/03/04

Correspondence :
Dr. A Amritha Bhandary
'Nalmane' Sowjanya Lane, Naigara Hills, Nikarnakatte.
P.O. Kulshekar, Mangalore 575005. (Karnataka).
Tel. 211843

The measurements were made with pelvimeter. DAWT (double abdominal wall thickness) was also measured with pelvimeter. If DAWT was more than 3 cms, the excess was deducted from transverse diameter and half the excess was deducted from the longitudinal diameter.

4. Hadlock's formula using ultrasound – After head circumference (HC), abdominal circumference (AC) and femur length (FL) were measured in centimeters, the sonography machine calculated the fetal weight.

The fetal weights estimated by the above four methods were compared with the actual weight of the baby after birth. A comparative analysis of the four methods was done.

Results

Out of the 200 women studied, 45% were primigravidas and 55% multigravidas. Seventy percent of the women had normal delivery, 19.5% had instrumental delivery and 10.5% had cesarean section. The cases were distributed as per the birth weight of the babies into five groups as shown in Table I. Maximum distribution of cases was in 2501 – 3000 grams fetal weight group.

Table I : Distribution of the cases according to birth weight

Groups	No. of cases	Percentage
I Less than 2000gms	14	7
II 2001 – 2500 gms	45	22.5
III 2501 – 3000 gms	108	54
IV 3001 – 3500 gms	30	15
V More than 3500 gms	3	1.5
Total	200	100

Average error in various fetal weight groups by the four methods is given in Table II. The average error in all the weight groups except in the more than > 3500 grams group was least with AG X SFH, closely followed by Hadlocks ultrasound method. Average error in the above 3500 grams group was least with Johnson's formula.

The number of under and over estimations in all the fetal weight groups for all the methods were calculated. AG X SFH method and Dawn's formula had a tendency to under estimate the fetal weight. The other two methods overestimated the fetal weight. In the above 3500 grams fetal weight group, all methods had a tendency to underestimate the fetal weight.

Maximum error in all fetal weight groups by the four methods is given in Table III. Maximum error was most marked with Dawn's formula and least with AG X SFH. Maximum error by AG X SFH and Dawn's formula was seen in 3001-3500 grams fetal weight group. In Johnson's formula it was seen in less than 2000 grams fetal weight group and in Hadlock's method, it was seen in 2001-2500 gram fetal weight group.

Table II : Average error in various fetal weight groups by various methods

Method	Birth weight (gms)					
	< 2000 N = 14	2001-2500 n = 45	2501 – 3000 n = 108	3001 – 3500 n = 30	>3500 n = 3	All Cases n = 200
	Average Error (gms)					
AG X SFH	301.2	218.25	213.44	207	182	224.37
Dawn's	365.57	376	381.97	407.5	790.66	464.35
Johnson's	415.4	339.69	299.48	300	108	292.51
Hadlock's	362.57	256.2	217.42	219.37	440	299.11

Percentage error of the method was calculated using the formula –

Percentage error = x / y x 100
x = error in grams
y = actual birth weight in grams

As seen in Table IV, 85.5% of cases came within 15% of birth weight by both AG X SFH and Hadlock's ultrasound method. As compared to that, only 50% and 63.5% came within 15% of birth weight by Dawn's and Johnson's formula respectively.

Table V compares the standard deviation of prediction error by all the methods. It was 258.48 grams by Hadlock's ultrasound method, closely followed by 272.66 gms by AG X SFH. It was much higher with Johnson's and Dawn's formulas. The variance between the four methods was statistically significant ($p<0.05$).

Table III : Maximum error in various fetal weight groups by various methods

Method	Birth Weight					
	<2000 Gms	2001 – 2500 gms	2501 – 3000 gms	3001 – 3500 gms	>3500 gms	All Cases n = 200
	Maximum error (gms)					
AG X SFH	530	584	610	734	213	534.2
Dawn's	567	944	1057	1200	811	915.8
Johnson's	1135	770	815	675	175	714
Hadlock's	702	774	653	634	474	647.4

Table IV : Percentage error in the various methods

Percentge Error	AGXSFH method	Dawn's method	Johnson's method	Hadlock's USG method
Upto 5%	33.5%	15%	17%	27.5%
Upto 10%	67%	32.5%	41%	62%
Upto 15%	85.5%	50%	63.5%	85.5%
Upto 20%	94%	78%	79.5%	92.5%
Upto 25%	96.5%	89%	89.5%	96.5%

Table V : Standard deviation of prediction error

Method	Standard Deviation (gms)
AG X SFH	272.66
Dawn's	441.56
Johnson's	309.98
Hadlock's USG	258.48

Discussion

Equipped with information about the weight of the fetus, the obstetrician managing labor is able to pursue sound obstetric management decreasing perinatal morbidity and mortality. Symphysiofundal height is one of the important parameters taken for estimating fetal weight as in AFG X FSH method, Johnson's formula, Dawn's formula and the formula developed by Mhaskar et al [5].

Dare et al[4] found a percentage error between the actual and the estimated weight to be 20.1%, by AG X SFH method. In the present study, the average error in various fetal weight groups by AG X SFH was 224.37 gms which was least when compared to other methods. It was 299.11 grams by Hadlock's method and higher for the other two methods (Table II). Tiwari and Sood[6] in their study showed an average error of 364.96 grams, 224.82

grams, 327.28 grams and 198.6 grams by applying clinical, Dawn's, Johnson's and Warsof's ultrasound method respectively.

In our study, average maximum error was the least by AG X SFH method followed by Hadlock's ultrasound method (Table III). In 85.5% of the cases, percentage error was restricted to 15% by AG X SFH and by Hadlock's ultrasound method, compared to 50% and 63.5% by Dawn's and Johnson's formula respectively. Tiwari and Sood[6] found 92% of cases within 15% of error by ultrasound method and 74%, 68% and 78% by clinical, Dawn's and Johnson's methods respectively. Dawn et al[7] using estimation by Dawn's formula, showed that 100% of cases were within 10% of actual birth weight as compared to only 32.5% cases in the present study. This can be partially explained by the fact that they considered only those women with vertex just sitting at the brim, whereas in our study all the women irrespective of the station of the head, were included since the obstetrician needs to estimate fetal weight irrespective of the station of the fetal head.

The standard deviation of prediction error was the least for Hadlock's ultrasound method, viz. 258.48 gms. It was 272.66 gms for AG X SFH and much higher for the other two methods (Table V). Tiwari and Sood[6] recorded that standard deviation of prediction error was 462.11 gm, 429.13 gm, 338.75 gms and 203.02 gms by using clinical, Dawn's, Johnson's and Warsof's ultrasound method respectively.

Hadlock's ultrasound method has the least standard deviation of prediction error in estimating the fetal weight. Of the three clinical formulas studied, AG X SFH has better predictable results in fetal weight estimation compared to other two formulas. The AG X SFH clinical formula can be of great value in a developing country like ours, where ultrasound is not available at many health care delivery systems. It is easy and simple and can be used even by midwives.

References

1. Sherman DJ, Joseph SA, Tovbin J et al. A comparison of clinical and ultrasonic estimation of fetal weight. *Obstet Gynecol 1998; 91:212-7.*
2. Baum JD, Gussman D, Wirth JC 3rd. Clinical and patient estimation of fetal weight vs ultrasound estimation. *J Reprod Med 2002; 47:194-8.*
3. Titapant V, Chawan PS, Mingnitpatanakul KA. Comparison of clinical and ultrasound estimation of fetal weight. *J Med Assoc Thai 2001; 84: 1251-7.*
4. Dare FO, Ademowore AS, Ifaturoti OO et al. The value of symphysiofundal height / abdominal measurements in predicating fetal weight. Int *J Gynecol Obstet 1990;31:243-8.*
5. Mhaskar R, Mhaskar A, Molly SR. Symphysiofundal height (SFH) measurement for prediction of birth weight – A new formula. *J Obstet Gynecol Ind 2001;51:73-6.*
6. Tiwari R, Sood M. Comparitive study of various methods of fetal weight estimation at term pregnancy *J Obstet Gynecol Ind 1989;39:279-86.*
7. Dawn CS, Modak GC, Ghosh A . A simple procedure for determination of antenatal fetal weight. *J Obstet Gynecol Ind 1983;33:133-7.*