Estimation of fetal actual weight with various methods in term pregnancy - a comparison.

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Abstract

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.

Methods: The fetal weight in-utero was calculated by using the above methods in 100 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 other formulas like Johnson's formula. 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.

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., Baum et al and Titapantel all 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. Dareeta14 used the product of symphysio fundal 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 symphysio fundal height (centimeters) (AGXSFH), Johnson'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:

One hundred women at term pregnancy were studied. The fetal weight was estimated within a week prior to delivery. If the delivery did not occur within a week of the estimations, the estimations were repeated and the serial estimations were taken into consideration. Cases of multiple gestation, mal presentation poly hydramnios or oligo hydramnios and fibroids or adenexal masses were excluded from the study.
The study consisted of estimation of fetal weight using the following three methods.
1. Weight in grams:
Abdominal girth (centimeters) X symphysis fundal height (centimeters) (AG XSFH). Abdominal girth was measured at the level of the umbilicus. Symphysis fundal 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 symphysis fundal height in centimeters -x) X155. 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. 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 three methods were compared with the actual weight of the baby after birth. A comparative analysis of the three methods was done.

**Results:**
Out of the 100 women studied, 45% were primigravida and 55% multigravida. 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.

| Sl. No | Groups   | No. of Cases | Percentage |
|--------|----------|--------------|------------|
| 1.     | < 2000 gms | 7            | 7          |
| 2.     | 2001-2500 gms | 23        | 23         |
| 3.     | 2501-3000 gms | 54        | 54         |
| 4.     | 3001-3500 gms | 15        | 15         |
| 5.     | >3500 gms   | 1           | 1          |
| Total  |           | **100**     | **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 XSFH, closely followed by Hadlock 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. AGXSFH method had 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 three methods is given in Table III. Maximum error was most marked with Hadlock's formula and least with AG XSFH. Maximum error by AGXSFH 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 2: Average error in various fetal weight groups by various methods

| Method     | Birth weights (in Gms) | < 2000 | 2001-2500 | 2501-3000 | 3001-3500 | > 3500 | All cases |
|------------|------------------------|--------|-----------|-----------|-----------|--------|-----------|
| AG X SFH   | n = 14                 | n = 45 | n = 108   | n = 30    | n = 3     | n = 100|
|            | Average error (gms)    | 301.2  | 218.25    | 213.44    | 207       | 182    | 224.37    |
| 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 = \( \frac{x}{y} \times 100 \)

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 63.5% came within 15% of birth weight by Johnson's formula.

Table V compares the standard deviation of prediction error by all the methods. It was 258.4 grams by Hadlock's ultrasound method, closely followed by 272.66 gms by AGX SFH. It was much higher with Johnson's formula. The variance between the three methods was statistically significant (p < 0.05)

Table 3: Maximum error in various fetal weight groups by various methods

| Method     | Birth weight | <2000 Gms | 2001-2500 gms | 2501-3000 gms | 3001-5000 gms | >3500 gms | All Cases n=200 |
|------------|--------------|-----------|---------------|--------------|--------------|-----------|-----------------|
| AG X SFH   |              | 530       | 584           | 610          | 734          | 213       | 534.2           |
| Johnson’s  |              | 1135      | 770           | 815          | 675          | 175       | 714             |
| Hadlock’s  |              | 702       | 774           | 653          | 634          | 474       | 647.4           |

Table 4: Percentage error in the various methods

| Percentage Error | AGXSFH method | Johnson’s method | Hadlock’s method |
|------------------|---------------|------------------|------------------|
| Up to 5%         | 33.5          | 17               | 27.5             |
| Up to 10%        | 67            | 41               | 62               |
| Up to 15%        | 85.5          | 63.5             | 85.5             |
| Up to 20%        | 94            | 79.5             | 92.5             |
| Up to 25%        | 96.5          | 89.5             | 96.5             |

Table 5: Standard deviation of prediction error

| Method   | Standard Deviation (in gms) |
|----------|-----------------------------|
| AG X SFH | 272.66                      |
| Johnson’s| 309.98                      |
| Hadlock’s| 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. Symphysio fundal height is one of the important parameters taken for estimating fetal weight as in AGXSFH method, Johnson's formula and the formula developed by Mhaskar et al. Dareta1 found a percentage error between the actual and the estimated weight to be 20.1%, by AGXSFH method. In the present study, the average error in various fetal weight groups by AGXSFH was 224.37 gms which was least when compared to other methods. It was 299.11 gms by Hadlock's method and higher for the other methods (TableII). Tiwari and Sood7 in their study showed an average error of 364.96 gms, 327.28 gms and 198.6 gms by applying clinical, Johnson's and Warsof's ultrasound method respectively.
In our study, average maximum error was the least by AGXSFH method followed by Hadlock's ultrasound method (Table III). In 85.5% of the cases, percentage error was restricted to 15% by AGXSFH and by Hadlock’s ultrasound method, compared to 63.5% by Johnson’s formula. Tiwari and Sood found 92% of cases within 15% of error by ultrasound method and 74% and 78% by clinical and Johnson’s method respectively.

The standard deviation of prediction error was the least for Hadlock’s ultrasound method, viz. 258.48 gms. It was 272.66 gms for AGXSFH and much higher for the Johnson’s formula (Table V). Tiwari and Sood recorded that standard deviation of prediction error was 462.11 gms, 338.75 gms and 203.02 gms by using clinical, 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 as studied, AGXSFH has better predictable results in fetal weight estimation compared to other two formulas. The AGX 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.

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