

Comparative Estimation of Fetal Weight in both Normal and High Risk Term Pregnancy by Clinical and Ultrasound Examination

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Abstract

Aim: To make a comparative estimation of fetal weight in both normal and high risk term pregnancy by clinical and ultrasound examination. *Materials and Methods:* This is a prospective hospital based study on 100 antenatal women attending Department of Obstetrics and Gynaecology admitted for planned delivery for various reasons either by elective caesarean section or by induction of labour. *Results:* Using Johnson's method 36% were within 5%, 67% were within 10% of the predicted fetal weight and in 67% of cases the birth weight was ± 200 gms of the predicted weight. In 92% of cases the birth weight was within ± 500 gms of actual birth weight as an acceptable limit to predict the fetal weight clinically. Johnson's method was least accurate when the birth weight is below 2500 gms and increased accuracy was found in the weight range of 2500 gms and above. Using Insler's (AG X SFH) method 49% of the cases birth weight was within 5% of the of the predicted weight. By using AG X SFH, birth weight was over estimated than under estimated. 71% cases were within ± 200 gms and 97% were within ± 500 gms of the predicted weight. Insler's method (AG X SFH) was found to be more accurate in weight range 2.501 to 3.5 kg. By Hadlock's formula 55% were within 5% of predicted fetal weight. 88% were within 15% of predicted fetal

weight. 76% gave error of ± 200 gms. It is most accurate between weight range of 2.5 to 3.5 kg weight group. While comparing all the three methods over estimation was almost equal with Ultrasonography and Insler's (AG X SFH) method. *Conclusion:* Insler's (AG X SFH) method which is simple, easy and less cumbersome method to predict the fetal weight in a developing country like India where sophisticated gadgets are not easily available.

Keywords: Johnson's Method; Insler's Method; Hadlock's Formula.

Introduction

Many obstetrical decisions are influenced by the weight of the fetus. Assessment of the fetal weight in utero leads to an improved prospective management of high risk pregnancies. Accurate estimation of fetal weight is of paramount importance in the management of labour and delivery. During the last decade, estimated fetal weight has been incorporated into the standard routine ante-partum evaluation of high-risk pregnancies and deliveries [1]. For instance, management of diabetic pregnancy, vaginal birth after a previous caesarean section and intrapartum management of fetuses presenting by the breech will be greatly influenced by estimated fetal weight [2,3]. Also, when dealing with anticipated preterm delivery, perinatal counseling on likelihood survival, the intervention undertaken to postpone preterm delivery, optimal route of delivery or the level of hospital where delivery should occur may be based wholly or in part on the estimation of expected birth-weight categorization of fetal weight into either small or large for gestational age may

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Received on 08.11.2017,
Accepted on 25.11.2017

lead to timed obstetric interventions that collectively represent significant departure from routine antenatal care [4-6].

High rate of perinatal mortality is still a major cause of concern in developing countries. A large proportion of this problem is related to birth-weight which remains the single-most important parameter that determines the neonatal survival. Many obstetrical decisions are influenced by the weight of the fetus. Antenatal fetal weight predictions specially useful when the fetus is at risk of premature delivery and when a decision has to be made requiring induction of labour and deciding on vaginal or operative delivery. The following are important conditions where fetal weight estimation is of utmost value such as pre-term labour and pre-mature rupture of membranes Breech presentation, transverse lie and unstable lie, Small for gestational age fetus where early delivery is considered, Multiple pregnancy, Previous caesarean deliveries to allow for trial of scar, Maternal medical conditions which will improve after delivery like pregnancy induced hypertension where early termination may be planned if the fetus is of adequate weight, Maternal diabetes where macrosomia should be ruled out when planning for a vaginal or abdominal delivery.

Assessment of fetal weight is important in both small for gestational age fetus and large for gestational age fetuses. Making a diagnosis of IUGR is important because these fetuses are at an increased risk of antepartum, intrapartum distress and neonatal morbidity. Likewise large for gestational age fetuses are at an increased risk of prolonged, difficult labour, intrapartum asphyxia, intracranial birth injuries and shoulder dystocia. Estimation of fetal weight could be done clinically by various methods and formulae, but these are applicable only to normal patients with no obstetric complications and not in the extremes of fetal weight and in high risk cases such as malpresentation over distended uterus, etc.

Materials and Methods

This is a prospective hospital based study. Booked antenatal women who have completed 37 weeks both high and low risk obstetric population were taken into the study. This study was conducted in Department of Obstetrics and Gynaecology, Bhagwan Mahavir Hospital and Research Centre, Hyderabad. 100 antenatal women attending Department of Obstetrics and Gynaecology admitted for planned delivery for various reasons either by elective caesarean section or by induction of labour. Study

subjects were selected by using systematic random sample technique

Inclusion Criteria

Singleton pregnancies, vertex presentation, gestational age > 37 weeks, booked case for hospital delivery, previous caesarean section, pregnancy induced hypertension, gestational diabetes mellitus, anaemia and hypothyroidism.

Exclusion Criteria

Congenital anomalies of the fetus, Multiple gestation, Malpresentation, Polyhydramnios

A detailed history was taken and clinical examination was done as in proforma. Both high and low risk antenatal women are included in the study. Actual weight of the baby was measured soon after the delivery.

Fetal Weight Estimation by Clinical Methods

All the patients had emptied their bladder, dextrorotation was corrected before taking the symphysio fundal height measurement. The parturient women were in the supine position with slight flexion of the knees. Clinical examination was done at that time fundal height, abdominal circumference measurement were taken. Later on all the patients were subjected to ultrasonography. Using the flexible tape measure calibrated in cms. fundal height measurement was performed according to a standard method. Using this tape, fundal height was measured from the highest point on the uterine fundus to the midpoint of the upper border of the symphysis pubis, using the thumb to sustain the tape, by attempting to reach the upper border of symphysis pubis. The abdominal circumference was also measured at the level of umbilicus. Station of the presenting part was assessed by pervaginal examination.

Johnson's Formula

Mc Donald's measurement of height of fundus from upper border of symphysis pubis following the curvature of the abdomen was taken in cms. tape.

Insler's method - Fundal height multiplied by abdominal girth measurement in cms. was used for calculating fetal weight in grams.

Fetal Weight Estimation by Ultrasonography: Ultrasound uses many fetal parameters such as Biparietal Diameter (BPD), head circumference (HC),

Abdominal circumference (AC), Femur length (FL) into account. The sonologist takes standard sonography measurements of BPD, HC, AC, & FL using Toshiba model USBO 221A / S1A with 3.75 MHz convex probe, was performed and estimated fetal weight was calculated as per Hadlock's formula.

Data are presented as mean (SD) or median values and comparisons were performed by using computer SPSS 15.0 package.

Results

Of the 100 women recruited to the study, both high and low risk booked anenatal women are present.

Out of 100 study subjects, 19% of cases were below 20 years age group, 69% (maximum) were present in

21-29 years age group and 12% were present in > 30 years age group. Maximum cases taken in this study were primi gravidas. Of the 100 study subjects, 54% of new born were male and 46% of the newborn were female. Out of the 100 study subjects, maximum number of patients delivered at 38 wks period of gestation (46%). 50% of the patients had normal vaginal delivery.

Out of the 100 study subjects, less error is seen in low risk group and the study subjects with risk factors had higher standard error in prediction of fetal weight.

By Insler's method standard error was least (41.97) in fetal weight between 2.501 to 3.5 kg group but by Hadlocks it was least in < 2.5 kg and more (117.67) in > 3.501 kg wt. group.

Table 1: Demographic distribution in study

| Variable | Number | Percentage |
|----------------------------|--------|------------|
| Age | | |
| ≤ 20 | 19 | 19% |
| 21 - 29 | 69 | 69% |
| ≥ 30 | 12 | 12% |
| Parity | | |
| 0 | 51 | 51% |
| 1-2 | 46 | 46% |
| ≥3 | 3 | 3% |
| Period of gestation | | |
| 37 weeks | 17 | 17 |
| 38 weeks | 46 | 46 |
| 39 weeks | 26 | 26 |
| 40 weeks | 8 | 8 |
| 41 weeks | 3 | 3 |
| >42 weeks | Nil | |
| Mode of Delivery | | |
| Normal vaginal delivery | 50 | 50% |
| Forceps | 11 | 11% |
| Caesarean section | 39 | 39% |
| Total | 100 | 100% |

Table 2: Fetal weight according to their risk factors

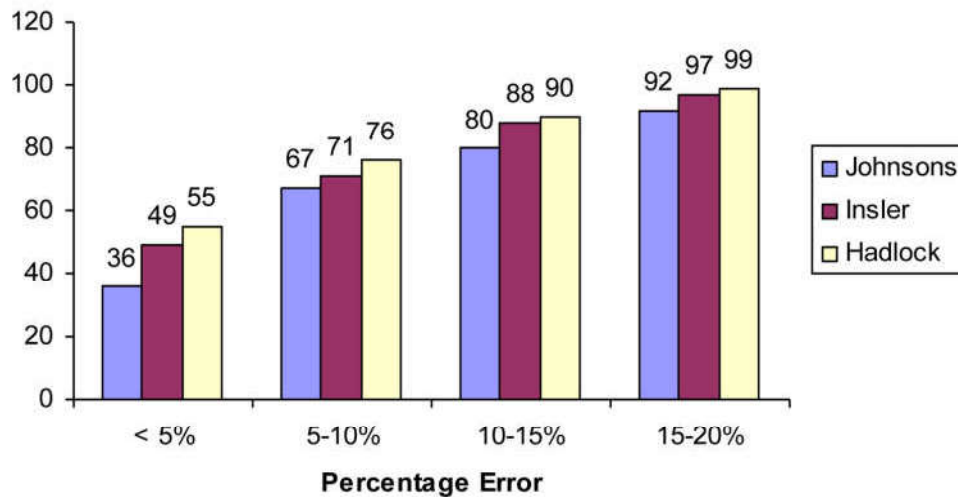
| Risk Factors | Mean fetal weight | Std. Deviation | Std. Error |
|----------------|-------------------|----------------|------------|
| Low risk | 2831.9 | 341.81 | 44.88 |
| PIH | 2825.7 | 338.36 | 90.43 |
| GDM | 3416.6 | 144.33 | 83.33 |
| Previous CS | 2842.8 | 559.14 | 149.43 |
| Hypothyroidism | 3116.6 | 202.07 | 116.66 |
| Rh -ve | 3000 | - | - |
| Anaemia | 2704 | 262.92 | 99.37 |
| Total | 2851.4 | 377.73 | 37.77 |

Table 3: Fetal weight in different weight groups according to different formulas

| Method | Number of subjects | Fetal wt. Mean | Standard Deviation | Standard Error |
|------------------------|--------------------|----------------|--------------------|----------------|
| Johnsons <=2.5 | 25 | 2615.80 | 270.350 | 54.070 |
| 2.501-3.500 | 72 | 3105.83 | 382.513 | 45.080 |
| >=3.501 | 3 | 3668.33 | 236.766 | 136.697 |
| Inslers <=2.5 | 25 | 2542.52 | 211.905 | 42.381 |
| (AG X SFH) 2.501-3.500 | 72 | 3040.82 | 356.130 | 41.970 |
| >=3.501 | 3 | 3766.33 | 227.597 | 131.403 |
| Hadlock's <=2.5 | 25 | 2544.68 | 210.247 | 42.049 |
| 2.501-3.500 | 72 | 2920.36 | 412.558 | 48.620 |
| >=3.501 | 3 | 3717.33 | 203.817 | 117.674 |

Table 4: Distribution of subject according to fetal weight in age and different methods

| | < 2.5 kg | 2.501 – 3.5 kgs | > 3.5 kg | Mean Error |
|--|----------|-----------------|----------|------------|
| Average error in various fetal weight groups by various methods | | | | |
| Johnson | 282.6 | 244.31 | 165.0 | 230.6 |
| Inslers (AG x SFH) | 232.76 | 189.68 | 67 | 163.1 |
| Hadlock's | 213.48 | 175.53 | 142.67 | 177.2 |
| Maximum error in various fetal weight groups by various methods | | | | |
| Johnsons | 855 | 810 | 190 | 618.33 |
| Inslers (AG X SFH) | 694 | 668 | 126 | 496 |
| Hadlock's | 421 | 798 | 328 | 515.66 |
| Standard deviation of prediction error by methods in different weight groups | | | | |
| Johnson | 47.49 | 22.22 | 20.20 | 29.97 |
| Inslers (AG X SFH) | 37.46 | 19.35 | 33.50 | 30.10 |
| Hadlock's | 26.55 | 17.25 | 92.84 | 45.54 |

**Fig. 1:** Shows percentage error in the various methods

Standard deviation of prediction error by methods in different weight groups.

The Mean Error was least by Inslers method (163.1) compared to other methods. Maximum error was most marked with in Johnsons Formula least with AG x SFH method, Maximum error by AG x SFH method and Johnsons formula was seen in < 2500g fetal weight group. In Hadlock's formula it was seen in

2501-3500 gms group.

Our study shows that the ability to predict the expected birth weight less than 5% by Johnsons, Inslers and Hadlock's method are 36%, 49% and 55% respectively.

Upto 15% error 80% of the cases can be predicted accurately by Johnson, Inslers and Hadlock's method.

Discussion

The estimation of intrauterine fetal weight is the vital component of important correlated factors for the management of labor & delivery & many decisions are influenced by this measurement, especially those involving fetuses in breech presentations or suspicious of having macrosomia. As fetal weight cannot be measured directly, it must be estimated from fetal or maternal anatomic characteristics and until now the clinical and sonographic estimation are only two worldwide methods used in many centres. Clinical estimation by external palpation of fetal parts and uterine contour is easy to practice, inexpensive and reliable. Sonographic estimation, although widely used is some times inconvenient because of the cost, acquirement of instrument and well trained physicians. In developing countries clinical estimation is still useful and should be done first and limit sonographic study only in cases with another indications. 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 Insler's method, Johnson's formula. Dare et al [7] found a percentage error between the actual and the estimated weight to be 20.1% by Insler's method. In the present study, the percentage error by Insler's method was 16.97%. Overall mean error per case for all cases (100) was least by Insler's method (163.1) compared to ultrasonography (177.2) and Johnson's methods, (230.6) which was comparable to Bhandary Amritha A et al [8]; In Bhandary Amritha A studies, the average error in various fetal group by Insler's method was least 224.37 when compared to other methods it was 299.11 gms by Hadlock's method and higher for other two methods.

In 2007, Shittu AO, Kutio and colleagues [9] conducted a prospective study in south-west Nigeria and compared clinical versus sonographic estimation of fetal weight in 100 pregnant women and concluded that clinical method overestimated the birth weight while ultrasound underestimated it. Mean absolute % error of clinical method was smaller than that of sonographic method. In low birth weight (<2500gm) group, the mean errors of sonographic estimates were significantly smaller. No statistically significant difference was observed in all the measures of accuracy for the normal birth-weight range of 2500 - <4000gms and in the macrosomic group, ultra sonographic method underestimated birth weight,

while clinical method over estimated it. Clinical estimation of birth weight is as accurate as routine ultrasound estimation except in low birth weight babies. Therefore, the clinical method suggests weight < 2500gms, subsequent sonographic estimation is recommended to yield better prediction and to further evaluate fetal well being. In March 2007, Peregrine and colleagues [10] compared clinical and ultrasound estimation of birth weight prior to induction of labour at term in 262 women and concluded that the sensitivity and specificity of detecting a fetus weighing <3000g were 56% and 98% for doctor estimated fetal weight, 90% and 89% for woman herself EFW, 93% and 83% for Shepard EFW and 100% and 76% for Hadlock EFW and concluded in general clinical estimates of birth weight perform favourably compared with ultrasonographic estimates, ultrasound immediately prior to labour is more accurate at predicting the low or high birth weight fetus.

In 2002, Weiner Z, Ben-Shlomo and colleagues¹¹ examined clinical and ultra sonographic estimation of weight in large for gestational age fetus in a one year period and concluded that the sensitivity of clinical and ultra sonographic prediction of macrosomia was 68% and 58% respectively. The contribution of ultrasound, added to routine clinical estimation of fetal weight, was clinically insignificant apart from a further increase in caesarean section rate. In 2002, Farrell T, et al [12] studied the effect of body mass index on three methods of fetal weight estimation in 96 women and concluded that ultrasound estimation of fetal weight was better than maternal and clinical estimation of fetal weight and was not influenced significantly by maternal BMI. *BJOJ*, 2002, Jun: 109(6):651-7. In 2002, Onah HE, Ikene et al [13] studied the correlation between SFH and birth weight in 2646 parturients and concluded that SFH - derived birth weight centiles are useful alternatives to ultrasound especially in the birth weight range 2500 - 3999g. *Afr J Reprod Health*, 2002 Aug; 6(2):23-9. In 2002 March, Baum J.D. and colleagues [14] compared clinical and patient estimation of fetal weight versus ultrasound estimation in 200 pregnant women and concluded that there was statistically significant difference between clinical and sonographic estimates of fetal weight; of the estimates, 64.0% were within 10% of actual birth weight versus 62.5%. *J. Reprod Med*. 2002 Mar; 47(3):194-8. In our study, the percentage error was 16.97% which was less when compared to Dare et al study, may be due to less sample size taken but the overall prediction error was comparable to the Tiwari R, Sood M, Bhandary Amritha K studies. But upto 15% error our study was able to detect more number of cases when compared to the other studies.

Majority of the deliveries take place in the rural areas in our country of which most are under domiciliary condition. Under MCH teaching programme we can teach the medical and paramedical staff and birth attendants the fetal weight estimation by a simple and easy method to improve the maternal and perinatal mortality and morbidity. AG X SFH formula will thus be useful in MCH training programme.

Conclusion

To conclude, this study highlights the superiority of ultrasonography over other methods used for the fetal weight estimation in utero. It is safe, accurate and a convenient method. However, a careful assessment of the fetal weight made by an experienced obstetrician is still valuable specially in places where the facility of this modern ultrasonography is not available.

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