Comparison of Estimation of Fetal Weight by Clinical Method, Ultrasonography and its Correlation with Actual Birth Weight in Term Pregnancy

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Abstract

Objective: To make a comparative evaluation of estimated fetal weight with actual birth weight by using: 1. Aymphysiofundal height x abdominal girth (dares formulae) 2. Ultrasonography (hadlock formulae). **Materials and Methods**: A prospective comparative study was carried out at the Obstetrics and Gynecology Department and USG section of Department of Radio-diagnosis of Dr Vasantrao Pawar Medical College and research centre from August 2014 to December 2016, to compare the accuracy of clinical and ultrasonographic estimation of foetal weight with actual birth weight at term. One hundred pregnant women who fulfilled the inclusion criteria had their foetal weight estimated independently using clinical and ultrasonographic methods. **Results**: About three fourth of the study subjects were in normal weight range of 2.5-4 Kg while 16% were LBW and 8% were VLBW babies. Both Dare's and Hadlock's formulae shows good co-relation with actual birth weight across all weight ranges (r- 0.77 and 0.72; p<0.05 for both) with best correlation observed at weight range of 2.5 to 3.5 Kg. Correlation was slightly lower at extremes of weight at both end. In present study, on comparing prospectively clinical and sonographic methods of predicting birth weight prior to induction of labor at term, we found that clinical estimates appear to be as accurate as ultrasonographic ones. **Conclusion**: In developing country where ultrasound is not available in many health care delivery system, clinical estimation of foetal weight is an easy, cost effective and simple method.

Keywords: Dares, Foetal Birth-Weight, Hadlock Formulae, Pregnancy, Ultrasonography

1. Introduction

Assessment of fetal weight is a vital and universal part of antenatal care, not only in the management of labor and delivery but often during the management of high risk pregnancies and growth monitoring. During the last decade, estimated foetal weight has been incorporated into the standard routine antepartum evaluation of high risk pregnancies and deliveries[1]. Birth weight of an infant is the single most important determinant of newborn survival[1,2]. Both low and excessive fetal weights at delivery are associated with an increased risk of newborn complications during labor and puerperium. It has been suggested that accurate estimation of foetal weight would help in successful management of labour and care of the newborn in the neonatal period and help avoidance of complications associated with foetal macrosomia, low birth weight babies, thereby decreasing perinatal morbidity and mortality[2,3]. The two main methods for predicting birthweight in current obstetrics are:

(a) clinical techniques based on abdominal palpation of foetal parts and calculations based on fundal height and (b) sonographic measures of skeletal foetal parts[4-6].

Ultrasound estimation of fetal weight, while being accurate to a degree, is associated with error ranging from ±6 to 11% depending on parameters measured and the

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equation used for estimation[7]. Although some investigators consider sonographic estimates to be superior to clinical estimates, others in comparing both techniques concurrently concluded that they confer similar level of accuracy[8–10]

The aim of this study was to determine which method of fetal weight estimation (clinical or sonographic) is more accurate. This will help in appropriate decision making in the management of the pregnant woman.

2. Materials and Methods

This prospective comparative study was carried out at the Obstetrics and Gynaecology Department and USG section of Department of Radio-diagnosis of a Medical College of tertiary health care sector from August 2014 to December 2016. The study population included mothers with singleton term pregnancy in cephalic presentation, admitted either for normal vaginal delivery, elective caesarean section or induction of labour. 100 patients were included in the study after fulfilling the inclusion and exclusion criteria's.

Sample size: minimum of 87 cases.

2.1 Eligibility Criteria

2.1.1 Inclusion Criteria

- All pregnant patients above 18 years of age attending ANC OPD.
- All patients with singleton viable pregnancy in cephalic presentation at term.
- All patients coming in early stages of labour.

2.1.2 Exclusion Criteria

- Pregnant patient with fetal congenital anomalies.
- Patients with multiple pregnancies.
- Patients coming in late phases of labor.
- Malpresentation.
- Patients with pelvic mass.
- Intra-uterine death.
- Polyhydroamnios/oligohydroamnios.

The study consisted of estimation of fetal weight using the following methods:
1. Clinical estimation of fetal weight by Dares formulae.

Dares formulae:
Weight in grams = Abdominal Girth (centimeters)x Symphysio-Fundal Height (centimeters) (AGXSFH).

- Abdominal girth was measured at the level of the umbilicus.
- Symphysio-fundal height was taken after correcting the dextrorotation, from the upper border of the symphysis to the height of the fundus.

2. Ultrasound estimation of fetal weight by Hadlock's formula.
Hadlock's formula:

- After the Head Circumference (HC), Abdominal Circumference (AC) and Femur Length (FL) of the fetus were measured in centimeters, the sonography machine calculated the fetal weight.

3. Results

A total of 100 patients were studied during the period from August 2014 to December 2016 in the Department of Obstetrics And Gynaecology and Sonography Unit of Radio diagnosis at a tertiary health care centre.

Table 1. Distribution of subjects based on Age of Mother, Gestational age, Parity

Age of Mother (years)	No. of patients	Percentage%
20-25	61	61.0%
26-30	38	38.0%
31-35	1	1.0%
Gestation Age (weeks)		
37-38	29	29.0%
39-40	63	63.0%
>40	8	8.0%
Gravidity		
Primi-gravida	38	38.0%
2nd Gravida	39	39.0%
3rd Gravida	16	16.0%
4th Gravida	7	7.0%
Total	100	100.0%

Out of 100 patients examined, most of the study subjects were between 20-25 years of age (61%) with mean age of 24.59 years. Median period of gestation was 39 weeks with most of the females between 39-40 weeks of gestation (63%). Out of 100 patients, maximum number of patients was 2nd gravida at 39% followed by primigravida at 38%. (Table 1).

Table 2. Distribution of subjects based on Birth weight (kg)

Birth Weight (kg)	N	%
1.5 - 2.0	8	8.0%
2.1-2.5	16	16.0%
2.6-3.0	40	40.0%
3.1-3.5	28	28.0%
3.6-4.0	8	8.0%
Total	100	100.0%

Out of 100 patients examined, 8 patients delivered babies with actual birth weight in the range of 1.5-2 kg accounting 8% of total. 16 patients delivered babies with actual birth weight in the range of 2.1-2.5 kg accounting 16% of total. 40 patients delivered babies with actual birth weight in the range of 2.6-3.0 kg accounting 40% of total.

28 patients delivered babies with actual birth weight in the range of 3.1-3.5 kg accounting 28% of total. 8 patients delivered babies with actual birth weight in the range of 3.6-4.0 kg accounting 8% of total (Table 2).

Mean birth weight as predicted by Hadlock's and Dare's formulae was 2.90 and 3.07 kg respectively. The mean actual birth weight was 3.01 kg.

This shows that USG based formulae's predict the foetal weight on a lower side while clinical formulae predicts it a slightly on higher side (Table 3).

The mean error (%) in predicting birth weight by Dare's and Hadlock's formulae was -2.09% and -3.56% while mean error as measured in grams was 60.0 gm and -111.0 gm respectively (Table 4).

The agreement as per weight category for dare's formulae was 89% as most of the babies predicted to be of normal weight range was in fact were between 2.5 to 4 kg at birth, only one baby which was predicted to be weighing over 2.5 kg was below 2.5 kg. For rest of the discrepant measurements Dare's formulae predicted the weight slightly on higher side. (Table 5)

The agreement as per weight category for Hadlock's formulae was 75% as most of the babies predicted to be of normal weight range were in fact between 2.5 to 4 kg at birth, only one baby predicted to be weighing over 2.5 kg was below 2.5 kg.

While, half of the babies i.e., 8/16, for which prediction was for <2.5 kg were in fact had normal birth weights. This shows that Hadlock's formulae predict the weight slightly on lower side (Table 6).

Table 3. Distribution of subjects based on mean birth weight predicted by Hadlock's and Dare's formulae and Actual Mean Weight. (kg)

Birth Weight	Mean	Median	SD	Minimum	Maximum
Hadlock Formulae	2.90	2.90	0.39	1.50	3.80
Dare's Formulae	3.07	3.10	0.45	1.69	3.89
Actual Weight	3.01	3.00	0.49	1.60	3.80

Table 4. Distribution of subjects based on Mean deviation from actual birth weight as predicted by Hadlock and Dare's formulae

Deviation in Estimation of Birth Weight	Mean	SD
Dare's (%)	2.09%	3.05%
Hadlock's (%)	-3.56%	4.12%
Dare's (Kg)	0.06	0.43
Hadlock's (Kg)	-0.11	0.39

**Table 5.** Comparison of Actual Birth weight vs Weight predicted by Dare's formulae across various ranges

Actual Birth Weight (Kg)	Dare's Birth Weight (Kg)					Total
	1.5-2.0	2.1-2.5	2.6-3.0	3.1-3.5	3.6-4.0	
1.5-2.0	4	1	0	0	0	5
	80.0%	20.0%	0.0%	0.0%	0.0%	100.0%
2.1-2.5	1	10	1	0	0	12
	8.3%	83.3%	8.3%	0.0%	0.0%	100.0%
2.6-3.0	0	1	39	3	0	43
	0.0%	2.3%	90.7%	7.0%	0.0%	100.0%
3.1-3.5	0	0	2	26	2	30
	0.0%	0.0%	6.7%	86.7%	6.7%	100.0%
3.6-4.0	0	0	0	0	10	10
	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Total	5	12	42	29	12	100
	5.0%	12.0%	42.0%	29.0%	12.0%	100.0%

Table 6. Comparison of Actual Birth weight vs Weight predicted by Hadlock's formulae across various ranges

Actual Birth Weight (Kg)	Hadlock's (BW in Kg)					Total
	1.5-2.0	2.1-2.5	2.6-3.0	3.1-3.5	3.6-4.0	
1.5-2.0	5	0	0	0	0	5
	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2.1-2.5	3	8	1	0	0	12
	25.0%	66.7%	8.3%	0.0%	0.0%	100.0%
2.6-3.0	0	7	33	3	0	43
	0.0%	16.3%	76.7%	7.0%	0.0%	100.0%
3.1-3.5	0	1	6	22	1	30
	0.0%	3.3%	20.0%	73.3%	3.3%	100.0%
3.6-4.0	0	0	0	3	7	10
	0.0%	0.0%	0.0%	30.0%	70.0%	100.0%
Total	8	16	40	28	8	100
	8.0%	16.0%	40.0%	28.0%	8.0%	100.0%

Table 7. Assessment of co-relation between actual birth weight and predicted birth weight as per various predictors

Birth Weight	Person Co-relation			
	Hadlock's		Dare's	
	r-value	p-value	r-value	p-value
1.5 - 2.0	0.63	**<0.01**	0.67	**<0.01**
2.1-2.5	0.73	**<0.01**	0.75	**<0.01**
2.6-3.0	0.74	**<0.01**	0.82	**<0.01**
3.1-3.5	0.70	**<0.01**	0.81	**<0.01**
3.6-4.0	0.65	**<0.01**	0.72	**<0.01**
Overall	0.72	**<0.01**	0.77	**<0.01**
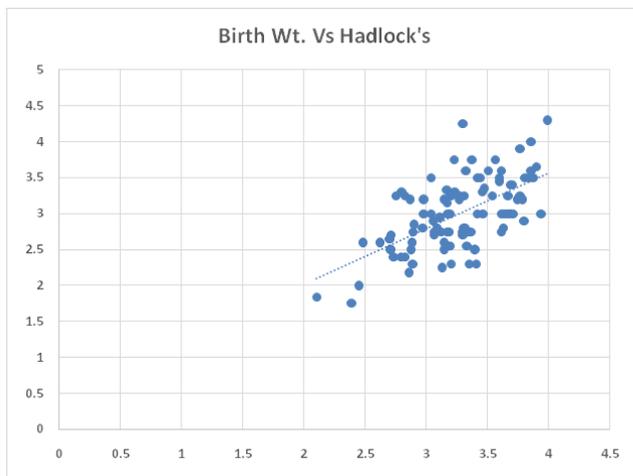
Figure 1. Actual birthweight vs prediction by Hadlock formulae.
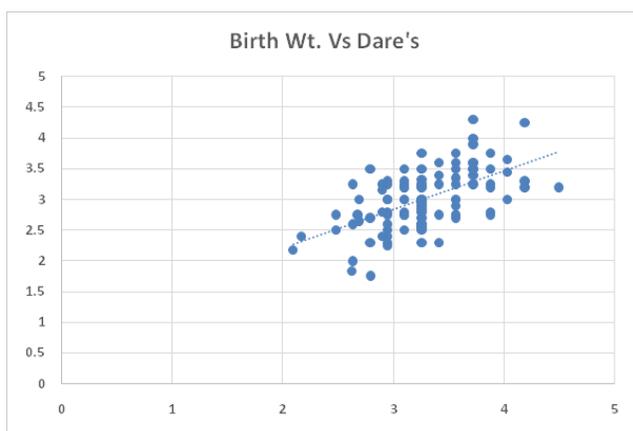
Figure 2. Actual birthweight vs prediction by Dares formulae.

Both Dare's and Hadlock's formulae shows good co-relation with actual birth weight across all weight ranges (r- 0.77 and 0.72; p<0.05 for both) with best correlation observed at weight range of 2.5 to 3.5 Kg. Correlation was slightly lower at extremes of weight at both end (Table 7) (Figure 1 & 2).

4. Discussion

Birth weight is a key variable affecting fetal and neonatal morbidity. In addition, it is of value in the management of breech presentations, diabetes mellitus, trial of labour, macrosomic fetuses and multiple births[11]. Both fetal macrosomia and Intrauterine Growth Restriction (IUGR) increase the risk of perinatal morbidity and mortality and of long-term neurologic and developmental disorders. Identification of intrauterine growth restriction after 37 weeks gestation is an indication for delivery to reduce the chance of foetal mortality. Similarly, diagnosis of macrosomia frequently leads to delivery by means of caesarean section to reduce risk of failed vaginal delivery and shoulder dystocia[12].

It is routine obstetric practice to estimate fetal weight by measuring the symphysio-fundal height at each antenatal visit and to refer on for a sonographic estimation if it varies from the normal range for the gestation. Early expectation that ultrasonography might provide an objective standard for identifying foetuses of abnormal size for gestational age was recently undermined by prospective studies that showed sonographic estimates of foetal weight to be no better than clinical palpation for predicting foetal weight[13–15].

Today, sonographic predictions are based on algorithms using various combinations of foetal parameters, such as Abdominal Circumference (AC), Femur Length (FL), Biparital Diameter (BPD), and Head Circumference (HC) both singly and in combination. The above modern algorithms are generally comparable in terms of overall accuracy in predicting birth weight. When other sonographic foetal measurements are used for estimating foetal weight, e.g., humeral soft tissue thickness, ratio of subcutaneous tissue to femoral length, cheek-to-cheek distance, these non-standard measurements do not significantly improve the ability of obstetric sonography to help predict birth weight, except in special patients subgroup, e.g., mothers with diabetes[16].

Several technical limitations of the sonographic technique for estimating foetal weight are well-known. Among these are maternal obesity, oligohydramnios, and anterior placentation. Other disadvantages of ultrasonography are that it is both complicated and labour intensive, potentially being limited by suboptimal visualization of foetal structure. It also requires costly sonographic equipment and specially trained personnel. Although such expensive imaging equipment is widely available in developed countries, this is generally not the case in developing nations like ours where medical resources are scarce[17,18].

Clinically various calculations and formulae based on measuring uterine fundal height above symphysis pubis have been developed. Ojwang et al., used the product of symphysiofundal height and abdominal girth measurement at various levels in centimetres above the symphysis pubis in obtaining a fairly acceptable predictive value but with considerable variation from the mean[19]. To further simplify this method, Dare et al., in Oauthc, Ile-Ife, in 1988, used the product of symphysiofundal height and abdominal girth at the level of the umbilicus measured in centimetres and result expressed in grams to estimate foetal weight at term in-utero, and the estimate correlated well with birthweight[20]. Generally studies have shown that clinical Estimates of Fetal Weight (EFW) are atleast as accurate as ultrasound late in the third trimester and intra partum[21].

In present study, on comparing prospectively clinical and sonographic methods of predicting birth weight prior to induction of labor at term, we found that clinical estimates appear to be as accurate as ultrasonographic ones.

In present study, mean birth weight as predicted by Dare's and Hadlock's formulae was 3.07 and 2.90 Kg respectively (p-0.45; non-significant). The mean actual birth weight was 3.01 Kg. Both Dare's and Hadlock's formulae shows good co-relation with actual birth weight across all weight ranges (r- 0.77 and 0.72; p<0.05 for both) with best correlation observed at weight range of 2.5 to 3.5 Kg. Correlation was slightly lower at extremes of weight at both end.

In present study, mean error (%) in predicting birth weight by Dare's and Hadlock's formulae was -2.09% and -3.56% while mean error as measured in grams was 60.0 gm and -111.0 gm respectively. This shows that USG based formulae's predict the foetal weight on a lower side while clinical formulae predicts it a slightly on higher side.

Thus major finding from this study is that clinical estimation of foetal weight is as accurate as the ultrasonographic method of estimation within the normal birth weight range. Our study has important implication as in developing country like ours, where ultrasound is not available in many health care delivery systems specially in periphery clinical method is easy, cost effective, simple, accurate and can be used even by midwives.

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