

A SIMPLE PROCEDURE FOR DETERMINATION OF ANTENATAL FOETAL WEIGHT*

by

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The clinical assessment of foetal size is notoriously inaccurate. By MacDonald's rule using abdominal tape measurement of gravid fundus, the diagnostic accuracy was only 37 per cent (Cetrulo *et al*, 1977). In face, of non-availability of certain clinical method, serial ultrasound measurement of biparietal diameter, thorax or abdomen is now employed in assessment of foetal weight and growth where such facility is available. However, ultrasound cephalometry could not predict 19 per cent growth retarded fetuses (Campbell and Dewhurst, 1971).

In this work, a simple procedure for determination of foetal weight at term (38-40 weeks) had been designed and such estimates could be confirmed by birth weight on delivery.

Material and Methods

One hundred and sixty primigravid Bengalee Indian women were closely cared antenatally by the authors follow-

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ing booking at first trimester. They were repeatedly checked fortnightly and weekly during 28-40 weeks at Calcutta Eden Hospital antenatal clinic and high-risk pregnancy ward from January, 1978 till December, 1979.

These women were taken consecutively at reproductive age range between 18 to 34 years, educated, nutritionally normal, with height ranged from 142-165 cm. and were considered obstetrically normal with all routine laboratory data within normal limits. In them foetal presentation was vertex facing or sitting on the pelvic brim. High nonengaged and engaged vertex presentations were excluded. The last menstrual period and gestational age were accurately recorded. The simple procedures for foetal size determination were designed as follows.

1. The maximal vertical length of the gravid uterus in cm. was directly measured by the pelvimeter (a museum instrument now) from the superior border of the symphysis pubis to the summit of the uterine fundus (Fig. 1). This measurement is vertical length (L). The woman emptied her bladder before examination in supine position, knees semiflexed and abducted. The summit of the uterine fundus was first identified by gentle palpation by left index and middle finger touch in the relaxed state of the uterus. The

point was marked with a ball pen. The superior border of symphysis was carefully identified by right index and middle fingers. Two arms of pelvimeter were correctly placed on these two points.

2. The maximum transverse width of gravid uterus below the funds was first identified by palpation and pelvimeter arms were gently pressed on the points to get the transverse diameter (T) in cm. (Fig. 2).

3. Subumbilical abdominal wall was pinched up and the double abdominal wall thickness (DAWT) was also measured by the pelvimeter in cm (Fig. 3). All these measurements were recorded serially in centimeter at 28th week, 32nd week, 34th week, 36th week, 38th week, 39th week and 40th week of gestation. The results on these measures were computed with the help of an electronic calculator, the SDS were determined. At 38-40

weeks, birth weights of delivered living babies were accurately recorded.

The pelvimeter measure of uterine vertical length from the symphysis was 24 cm (in round figure) with a range between 23 to 25.5 cm at 38, 39, 40 weeks gestation. Thus there is no fall in uterine fundal height from symphysis from 38 through 40 weeks gestation, although clinically there is an apparent fall in fundal height at the upper abdominal site.

The standard double abdominal wall thickness was measured at 3 cm. for woman weighing 40-50 kg. Any woman with excess fat gave D.A.W.T. above 3 cm. and ran to 7 cm. Therefore a correction factor was made on this excess skin fold thickness. For any measure above 3 cm, half of the excess measure has to be deducted from the vertical length and total of the excess from the transverse measure.

TABLE I
Symphysis—Fundal (S.F.) Vertical Length (L) and Maximal Uterine Transverse Diameter (T) in cm. at 36-40 weeks gestation

Weeks gestation	No. of observations	Mean SF in cm (L)	S.D.	Mean Transverse (T) in cm.	S.D.
36	110	23.35 (21-24.5)	1.2	17.20 (15-18)	0.93
38	108	24.10 (23-25.5)	0.88	18.08 (14-20)	1.35
39	80	24.22 (23-25.5)	0.61	18.00 (15-20)	1.25
40	51	24.20 (23-25.5)	0.71	18.06 (14.5-20)	1.31

TABLE II
Uterine Volume Calculated From Uterine Vertical Length (L) and Transverse Diameter (T) at 36-40 Weeks Gestation

Weeks gestation	No.	Vertical length (L) in cm. (mean)	Transverse diam. (T) in cm. (mean)	Uterine volume in cc.
36	110	23.35	17.2	2343
38	108	24.25	18.08	2695
39	80	24.22	18	2668
40	51	24.20	18.06	2683

The uterine volume in c.c. was calculated by integral calculus from vertical length (L) and transverse uterine diameter (T). The formula worked at $0.433 \times \pi \times L \times (\frac{1}{2}T)^2$. This is calculated to $1.36 \times L \times (\frac{1}{2}T)^2$ taking $\pi = 3.14$. This formula was worked up taking late gravid uterus as pearshaped on graph paper with an apex at the symphysis pubis (Fig. 4) and the three dimensional shape being spherical. Thus actual volume is slightly bigger than this dummy uterus due to lower uterine segment volume. Table II shows rise in uterine volume from 36 to 38 weeks. Maximum volume at 38 weeks and more or less similar but reduced volume at 39 and 40 weeks. Taking uterine volume at 2695 c.c. and birth weight at 2841 gm. on 38 weeks, the factor

of 1.06 gm foetal weight at birth for every c.c. uterine volume can be obtained.

For further simplification, any doctor or nurse can calculate foetal weight in gm by Dawn's formula as $L \times (\frac{1}{2}T)^2 \times 1.44$ when the factor of 1.36 in main formula is multiplied by 1.06 gm foetal weight factor/c.c. uterine volume to get the factor of 1.44.

While working through the formula the calculated birth weight runs close to actual birth weight at 38 through 40 weeks, within an error of 10 per cent on either side.

Working at the above formula uterine volume and foetal weight can be estimated at preterm gestation weeks for normal foetal growth in Indian women.

TABLE III
Birth Weights Calculated From Uterine Volume and Actual Birth Weight at 38-40 Weeks

Weeks in gestation	Uterine volume (c.c.)	Multiplying F.W.* /c.c.	Calculated birth weight (gm)	Actual birth weight (gm)
38	2695	1.06	2856	2841 (161**)
39	2668	1.06	2828	2850 (164**)
40	2683	1.06	2843	2898 (194**)

* F.W. foetal weight. ** Standard Deviation.

TABLE IV
Uterine Vertical Length, Transverse Diameter, Uterine Volume and Calculated Birth Weight at 28-34 Weeks

Week of gestation	No.	Vertical length cm. (mean)	Transverse cm. (mean)	Uterine volume c.c.	Calculated birth weight in gm.
34	40	22.85 ± 1.02 (21-24.5)	17.18 ± 1.55 (14-20)	2293	2430
32	36	21.94 ± 1.4 (18-24)	16.14 ± 1.27 (13.5-19)	1943	2059
30	17	20.55 ± 1.17 (18-22.5)	15.8 ± 1.6 (14-18.5)	1744	1848.8
28	18	19.4 ± 0.79 (18-20)	16.2 ± 1.17 (15-18)	1731	1834.9

Discussion

Example I: Vertical length (L) is 23 cm, T is 18 cm, DAWT 3 cm. Working on the formula $L \times (\frac{1}{2}T)^2 \times 1.44$, predicted foetal weight in gm comes to $23 \times 9^2 \times 1.44 = \text{gm}$.

Example II: Vertical length (L) is 23 cm, T is 18 cm. DAWT 5 cm. Correction 5 cm is 2 cm excess of standard 3 cm. Thus 2 cm is deducted from T (18 cm) and corrected T comes to 16 cm. Half of 2 cm (1 cm) is deducted from L (23 cm), the corrected L comes to 22 cm. Working on the formula, predicted foetal weight comes to $22 \times 8^2 \times 1.44 = 2661 \text{ gm}$.

The measurements on pelvimeter can be taken upto 0.5 cm. However in the Tables, fractions of cm were reported while working on calculator for estimations of mean values. Any one (Obstetrician, house officer, nurse) can take these simple measurements by pelvimeter and predict birth weight. He/She remains in suspense to see how close the actual birth weight comes. If the measurement can be accurately taken, the prediction comes closer. Therefore on practice of taking several measurements the accuracy rises.

Currently by ultrasound, the uterine size was measured by Gohari *et al* (1977) wherein the uterine volume at 38-40 weeks in a sample of white women shows 2700-4800 c.c. (38 week), 3600-6000 c.c. (40 week). In this ultrasound mensuration the three dimensional measurement was taken ($L \times T \times AP \times 0.5233$). While working through Dawn's formula the uterine volume in this series measures at 2695 c.c. (38 weeks), 2668 c.c. (39 weeks) and 2683 c.c. (40 weeks). These measures for Indian women were at the lower level of the range of uterine volume when compared with those obtained ultrasonically for white women.

Devi *et al* (1966) worked on all the

current procedures available. They found Johnson's simplified method (1957) correct to 74%, McSweeney's method (1958) to 51% and Poulas *et al* method (1953) to 63%. Therefore none of these procedures was accepted in routine practice for determination of foetal weight.

Summary and Conclusion

This work could design a simple clinical procedure of estimating foetal birth weight. The procedure is to measure in cm. uterine vertical length and maximum transverse diameter with the help of pelvimeter. The infraumbilical double abdominal wall thickness (DAWT) was also measured by the pelvimeter. DAWT of 3 cm was taken as standard for Indian women weighing 40-50 kg. Fattening above 3 cm needs a deduction of half of the increased measure from vertical length and total excess from transverse diameter. From these simple measures, the foetal weight could be determined through Dawn's formula $L \times T \times (\frac{1}{2}T)^2 \times 1.44$ in gm. The actual birth weight came accurate within 10 per cent of predicted foetal weight working by this procedure. Further at any gestation beyond 28 weeks the average for date, small for date and large for date foetal weight could be antenatally determined.

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See Figs. on Art Paper II

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