

Development of Symphysis Fundal Height Curve

CHOWDHURY TASLIMA NASREIN¹, FERDOUSI BEGUM², JAGLUL HAIDER KHAN³,
NOVERA ISLAM⁴, ZAHANGIR ALAM⁵

Abstract:

Objective: To Develop a symphysis fundal height (SFH) curve of pregnant women from 20 weeks of pregnancy onwards; and to find out the relationship of fundal height with different variables.

Methodology: A cross-sectional hospital based study was conducted from 1st January 2010 to 31st December 2010 on 159 patients with gestation age less than 20 weeks at entry in the OPD of Department of Obstetric and Gynaecology, Shaheed Suhrawardy Medical College & Hospital, Shere-e Bangla Nagar, Dhaka, Bangladesh. All the patients were followed up till delivery.

Results: The measurements of SFH obtained on the basis of 10, 50th and 90th percentiles and the rate of growth of SFH was approximately 5 mm per week from 24 weeks to 36 weeks and thereafter it was 5-6 mm per week till 40 weeks. Patients with higher socio-economic class had higher symphysis fundal height. SFH is less in younger subjects. SFH increases with increased height, weight, gestational age, gravidity of mothers and birth weight of the baby. Multiparous was predominant and more than one third (34.6%) of the study patients height belonged to 1.51 - 1.60 meters. The mean \pm SD gestational age was 39.2 \pm 1.4 weeks with range from 28 to 41 weeks. Low birth weight was found 17.0% and the mean \pm SD birth weight was 2.8 \pm 0.4 kg with range from 1.9 to 3.8 kg.

Introduction:

Perinatal mortality in Bangladesh is extremely high 44/1000 live birth¹. This decreases the acceptance of family planning and increases the preference for large families to reduce the risk of childlessness. This in turn leads to overgrowth of population. One of the major causes of perinatal mortality in Bangladesh is low birth weight (LBW) of which intrauterine growth retardation (IUGR) is the majority.² In Bangladesh low birth weight rate is about 34%.¹ Early diagnosis of IUGR is important to take preventive measures.

There are several methods for diagnosis of IUGR such as, clinical palpation of fundal height in relation to anatomical landmark such as umbilicus and xiphisternum, serial measurement of symphysis fundal height in centimeters and serial sonography. These three are the available methods for foetal growth assessment. Palpation is subjective and has not been very useful as distance between anatomical landmarks vary. Serial sonography though accurate is not

practical as screening method for growth assessment in a developing country. Equipment is expensive and its operation requires special skill.

SFH measurement refers to the distance (measured in centimeters) over the abdominal wall from top of the uterus (fundus) to the upper border of the symphysis pubis. This measurement is taken along the long axis of the centralized uterus to the midline of the abdomen, using a non-stretch tape measure which remains in continuous contact with the skin surface of the abdomen. The fundal height measurement should, in general, corresponds with the number of weeks of gestation, with an allowance of 1-3 cm variation. A variation of +2 cm is accepted as normal. So from all points of view, low cost, high applicability, accepted validity and no potential harm have been the arguments in favour of SFH measurements as a routine method to detect fetal growth disturbances.³

1. Consultant, Obs & Gynae, Dhaka Medical College Hospital
2. Professor, Sir Salimullah Medical College.
3. Assistant Professor, Dhaka Medical College
4. Register, Dhaka Medical College Hospital
5. Senior Consultant, Dept. of Gynae & Obs., 300 Bedded Hospital, Narayanganj.

Address of Correspondence: Dr. Chowdhury Taslima Nasrein, Consultant, Obs & Gynae, Dhaka Medical College Hospital, Mobile: 0171605327, E-mail: rsgynaesecretary@yahoo.com

Carefully performed serial uterine fundal height measurements throughout gestation are a simple, safe, inexpensive and reasonable accurate screening method that may be used to detect many small for gestational age fetuses. Measurement the height of the uterine fundus above the symphysis can provide useful information. It is demonstrated that between 20 and 31 weeks the fundal height in centimeters equals the gestational age in week⁴. It also has high applicability and acceptable validity³. Systematic measurement of the upper border of symphysis pubis and the pregnant uterine fundus was first described by Mc Donald⁵. There was report that lack of uterine growth and leveling off of the growth curve during the third trimester agreed with a diagnosis of placental insufficiency⁶.

Considerable variation in abdominal length, the location of umbilicus and the fundal height were reported and it was found to be impossible to assess fetal maturity by a level in weeks of gestation. For that reason, the fundal height and its relation to abdominal landmarks seems to be of limited value⁷. Growth is frequently used to measure the nutritional status of population and individuals. Well known examples include infant weight chart and ultra sonogram fetal biometry⁶. In order to enhance the detection of intrauterine growth disturbances in routine care serial symphysial fundal height measurement were reported. Surveillance of serial symphysis-fundal height measurement demanded the use of reference chart, such a chart from the Cardiff, Wales⁸. In Bangladesh we do not have any reference chart of symphysis fundal height of our pregnant mothers. The chart/curve which we usually use is not from the same ethnic group as ours. Most of the countries have their own reference SFH chart for early detection, possible correction in time and appropriate preparation for delivery. There is an urgent need to develop a SFH chart in Bangladesh. So this study was undertaken to develop a SFH chart for Bangladeshi pregnant women.

Methods:

A cross-sectional hospital based study was conducted in Department of Obstetric and Gynecology, Shaheed Suhrawardy Medical College & Hospital, Shere-e Bangla Nagar, Dhaka from 1st January to 31st December, 2010. All consecutive subjects fulfilling inclusion criteria during the study period were enrolled in the study. Informed consent were taken from the participants and clearance from the ethical committee was also obtained.

Data was collected by direct interview, physical examination, investigation and reviewing records of the patients using a structured data collection instrument. To complete all the measurements of SFH of women who were recruited around 20 weeks of pregnancy were regularly followed up. All subjects were followed up regularly upto 40 weeks of gestation.

Inclusion criteria were Known date of last menstrual period; gestational period less than 20 weeks at entry; regular menstrual cycle of 28+2 days; uneventful singleton pregnancy and delivery; weight between the 10th and 90th centile for gestational age according to Lubchenco (1963) birth weight curves and delivery between 37 to 42 weeks.⁹

Women having any medical disorder or complication were excluded from the study.

Examination Methods:

The patient was positioned supine with only one pillow under the head for support, and fundus was identified without applying pressure on abdomen. The upper edge of the fundus was marked on the surface of the abdomen using a pen. A tape calibrated in centimeter was applied over the abdominal curvature from symphysis pubis to the top of the uterine fundus, which was identified by palpation. The measurement was made after evacuation of the bladder and the tape was applied with the marking away from the examiner to avoid prejudice. A measurement was also taken of total maternal abdominal length i.e. from the upper border of the symphysis pubis to xiphisternum. Symphysis fundal height was measured at 2 weeks interval.

To derive the normal symphysis fundal height curve weekly means were calculated. The standard deviation of the measurement at each week of gestation was used to calculate the centiles norms, assuming normal distribution. These means and centiles then were used to construct the curve. The statistical methods used here, were in agreement with the study conducted in Cardiff⁵.

Results:

Majority (79.9%) of the patients were found to be of 20-34 years; 10.7% were of <20 years and 9.4% were >30 years age group. Regarding the level of education most (44.7%) of the patients has completed their secondary education. Majority of the patients were housewife and most of them came from middle socio economic class. Most (66.0%) of the patients came

from rural area. Regarding parity, 92(57.9%) were multi and 67(42.1%) were primi. The mean±SD parity was 2.0±1.3 with range from 1 to 6.

Regarding height of the study patients, they were divided into four height groups. More than one third 55(34.6%) of the study patients height belonged to 1.51 - 1.60 meters followed by 51(32.1%) had 1.40 meters and 40(30.8%) had 1.41 – 1.50 meters of height. The mean±SD height was 1.5±0.1 meters with range from 1.3 to 1.7 meters.

Table I
Distribution of the study patients according to gestational age (n=159)

Gestational age (wks)	Number of patients(n=159)	Percentage
28-34	3	1.9
35-37	2	1.3
38-40	154	96.9
Mean±SD	39.2±1.4	
Range (min - max)	(28-41)	

Table I shows the gestational age of the study patients and they were divided into three gestational age groups. Maximum 154(96.9%) of the study patients had 38 to 40 weeks of gestational age and the mean±SD gestational age was 39.2±1.4 weeks with range from 28 to 41 weeks.

Table II
Distribution of the study patients according to birth weight of the newborns (n=159)

Birth weight (kg)	Number of patients(n=159)	Percentage
1.9 - 2.4	27	17.0
2.5 - 3.0	94	59.1
>3.0	38	23.9
Mean±SD		2.8 ±0.4
Range (min - max)		(1.9 - 3.8)

Table II shows the birth weight of the new born and observed that, low birth was found 27(17.0%) and the mean±SD birth weight was 2.8±0.4 kg with range from 1.9 to 3.8 kg.

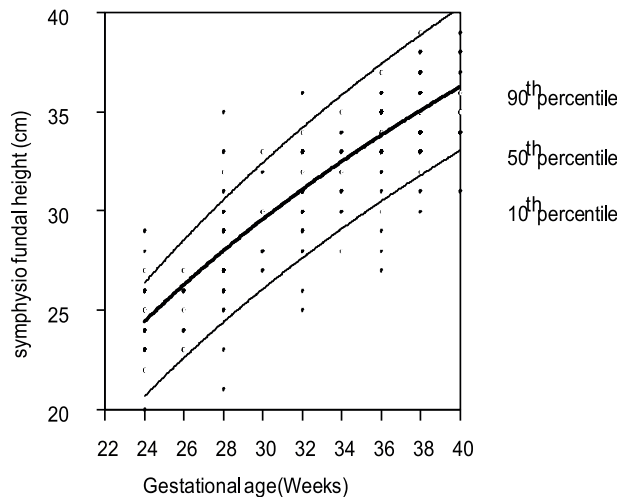
Table III
Fitted Centiles of uterine height (cm) for gestational age (estimated)

Gestational age (wks)	n	10th	50th	90th	Mean±SD	(Min-max)
24	36	22	25	27	24.7±2.0	(20-29)
26	13	23	25	27	24.8±1.6	(23-27)
28	80	26	28	32	28.4±2.3	(21-35)
30	14	28	30	33	29.9±1.8	(27-33)
32	123	30	32	33	31.4±1.8	(25-36)
34	17	30	32	34	32.1±1.8	(28-35)
36	134	33	34	36	34.3±1.6	(27-37)
38	96	33	35	36	34.8±1.4	(30-39)
40	29	34	35	38	35.4±1.5	(31-39)

The above table (table-III) shows the fitted centiles of uterine height (cm) for different gestational age (estimated).

As can be seen above, the regression of best fit is given when $a=-0.020$, $b=1.97$ & $c=-11.362$. Where a and b are coefficient and c is constant. The form of a quadratic equation of regression is given by $y=aw^2+bw+c$. Here, w = independent variable (uterine height). Substituting the values for a , b , and c into this form gives the equation for the quadratic function best fitting the data set:

$$y=11.362+1.974w-0.020w^2$$



Fitted model uterine height,
 Mean = $-11.362 + 1.974w - 0.020 w^2$
 $R^2 = 0.798$ ($p < 0.001$)

Fig. 1: Scatter plot of symphysis fundal height vs. gestational age (based on 561 measurements) combined with the locally composed 10th and 90th centile curves.

Fig.-1 shows scatter plot of SFH versus gestational age. SFH at different gestational age (between 22-40 weeks) was been plotted as 10th, 50th and 90th percentile.

Discussion:

Although tape measurement of SFH is simple, inexpensive, and non-invasive, the technique is still not widely used in clinical practice worldwide. This is probably because of the unavailability of standards for the charts, and the supposed need for SFH charts for each community. There is also the problem of intra and inter-observer variations, the relatively moderate screening power, and interpretation difficulties in women who are not sure about the date of their last menstrual period.

This cross-sectional hospital based study was carried out with an aim to measure serial symphysis fundal height chart, find out the serial clinical profile of the pregnant mothers, construct a chart and curve with period of gestation and symphysis fundal height and observe the social gradient of symphysis fundal height and also to compare the ultra sound findings with symphysis fundal height.

The height of the current study patients were divided into four height groups and found that more than one third (34.6%) of the study patients height belonged to 1.51 - 1.60 meters; 32.1% had < 1.40 meters and 30.8% had 1.41 – 1.50 meters of height. The

mean±SD height was 1.5±0.1 meters with range from 1.3 to 1.7 meters. Similarly, Walraven et al.¹⁰ found mean±SD height was 1.54±0.08 meters with ranged from 1.45 to 1.72 meters. Challis et al.¹¹ showed mean height was 1.6±0.065 meters in their study. Rai et al.¹² observed the maternal height ranged from 1.40 to 1.67 meters with the mean of 1.52 meters.

In this study it was observed that maximum (96.9%) of the study patients had 38 to 40 weeks of gestational age and the mean±SD gestational age was 39.2±1.4 weeks with a range from 28 to 41 weeks. Rai et al.¹² observed gestational age between 29 to 40 weeks of gestation and Challis et al.¹¹ observed 20 to 41 weeks of gestation which are comparable with the current study.

In this current study it was observed that the birth weight of the new born was found low at birth 17.0% and the mean±SD birth weight was 2.8±0.4 kg with range from 1.9 to 3.8 kg, which closely resembled with Challis et al.¹¹ study, where the investigators found the mean birth weight was 2.91 kg and low birth weight (< 2500 g) occurred 16.0% in their study. Similarly, Rai et al.¹² found the mean weight of the babies was 2.9 kgs.

In this current study the measurements of SFH obtained on the basis of 10, 50th and 90th percentiles. Increase in SFH measurement expressed as percentiles is similar to that of mean with standard deviation. The rate of growth of SFH was approximately 0.5 cm per week from 24 weeks to 36 weeks and thereafter it was 5-6 mm per week till 40 weeks. Rai et al. (1995) mentioned in their study that difference between mean and the SD were uniform in all weeks of gestation and found that the mean SFH increased from 18.9 cm at 20 weeks to 34.4 cm at 36 weeks. From 36 weeks to 40 weeks the increase was only 2.86 cms. The measurements obtained were also arranged on the basis of 10, 50th and 90th percentiles, which is consistent with the present study. The rate of growth of SFH was approximately 2.1 cm per week from 29 weeks to 32 weeks and thereafter it was 7-8 mm per week till 40 weeks. Almost similar corresponding values obtained by Walraven et al.⁹, Belizen et al.¹³, Mathai et al.¹⁴, Steingrimsdottir et al.¹⁵ and Munjanja et al.¹⁶.

In this current study it was observed that, mean symphysis fundal height was found 29.5 cm in <20 years, 31.8 cm between 20 - 25 years age group, 31.7 cm between 26 - 30 years age group and 31.7 cm in more than 30 years of age. Symphysis fundal height increased with height, which was 31.3cm in

≤140 meters height followed by 31.5 cm in 1.41-1.51 meter, 31.7 cm in 1.51 to 1.60 meter and 31.9 cm in 1.61 to 1.70 meter. Maximum mean symphysis fundal height was found in the weight group of 51 to 60 kg which was 31.8 cm. Symphysis fundal height increased with birth weight and found mean symphysis fundal height was 31.1cm in 1.9 – 2.4 kg birth weight; 31.6cm in 2.5 – 3.0 kg and 31.9cm in >3.0 kg. Maximum mean symphysis fundal height was observed in patients with para 6 which was 36.7 cm and para 1 to para 5 lays between 31.1cm to 32.1cm symphysis fundal height. Patients with higher socio-economic class had higher symphysis fundal height which was 35.7 cm followed by middle class (35.6 cm) and lower class (35.4cm).

Conclusion:

A demographically specific symphysis fundal height chart is a simple tool for monitoring intrauterine growth and screening for abnormal uterine growth. Applying this chart in routine antenatal check up may reduce unnecessary ultrasound in fully equipped settings and reduce unnecessary referring for further investigations in resource deprived settings.

Recommendation:

Most of the countries have their own reference SFH chart, but still in Bangladesh there is no reference SFH chart for pregnant mother. So this chart can be used as reference SFH chart for Bangladeshi pregnant mother.

References:

1. NIPORT, Bangladesh Demographic & Health survey, 2014.
2. Bangladesh Bureau of Statistics (2005), *National low birth weight survey of Bangladesh, 2003-2004*, XII..
3. Quaranter P, Currel R, Redman CWC and Robhison JS. Prediction of small for dates infants by measurement of symphysial fundal height, *British Journal of Obstetrics and Gynaecology* 1981; 88:115-19.
4. Jimnez JM, Tayson JE, Reisch JS, Clinical measurement of gestational age in normal pregnancies. *Obstet Gynaecol* 1983;16:438
5. McDonald E. Mensuration of the child in the uterus with new methods. *Journal of the American Medical Association*, 1906; 47; 1979-83
6. Westin B. Gravidogram and fetal growth. *Acta Obstetrica Gynaecologica Scandinavica*, 1977, 56,273
7. Beazley JM, Underhill RM. Fallacy of fundal height. *British Medical Journal*, 1970; iv, 404-6
8. Calvert JP, Crean EE, Newcombe RG and Pearson JF. Antenatal screening by measurement of symphysis-fundal height, *British Medical Journal* 1989;285:846-49.
9. Lubchenco LO, Hansman C, Dressler M, Boyd E. Intrauterine growth as estimated from live born birth-weight date at 24 to 42 weeks of gestation. *Paediatrics* 1963;32(5):793-800.
10. Walraven GE, Mkanje RJ, van Dongen PW, van Roosmalen J & Domans WM. The development of a local symphysis-fundal height chart in a rural area of Tanzania. *European Journal of Obstetrics Gynecology and- Reproductive Biology* year; 1995;60:149-152.
11. Challis K, Osman NB, Nystrom L, Nordahi G and Bergstrom. Symphysis-fundal height growth chart of an obstetric cohort of 817 Mozambican women with ultrasound-dated singleton pregnancies. *Tropical Medicine and International Health*; 2002;7:8;678-684.
12. Rai L, Kurien L and Kumar P (1995). Symphysis fundal height curve-a simple method for foetal growth assessment. *J postgrad Med*; 41: 93.
13. Belizan JM & Villar J (1978). Diagnosis of intrauterine growth retardation by a simple clinical method: measurement of uterine height. *American Journal of Obstetrics and Gynecology* 131, 643-646
14. Mathai M, Jairaj P & Muthurathnam S (1987) Screening for light-for-gestational age infants: a comparison of three simple measurements. *British Journal of Obstetrics and Gynecology* 94, 217-221.
15. Steingrimsdottir T, Cnattingius S & Lindmark G (1995) Symphysis-fundal height: construction of a new Swedish reference curve, based on ultrasonically dated pregnancies. *Acta Obstetrica Gynecologica Scandinavica* 74, 346-351.
16. Munjanja SP, Masona D, Maxwell M & Mahomed K (1987) A symphysial-fundal height nomogram for central Africa. *Central African Journal of Medicine* 33, 394-397.