## OBSTETRICS

# Intrapartum Prediction of Low Birth Weight Infant by Measurement of Symphysis-Fundus Height

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## ABSTRACT

**Objective**     To determine sensitivity, specificity, positive, and negative predictive values of intrapartum symphysis-fundus height measurement in the prediction of low birth weight infant, and to determine point of the best sensitivity and specificity of the measurement.

**Design**     Diagnostic test.

**Materials and methods**  Symphysis-fundus heights were measured in 1450 pregnant women who were admitted for delivery at Thammasat hospital between January 2000 and July 2000. Sensitivity, specificity, positive, and negative predictive values of the measurement were calculated by using low birth weight as a gold standard.

**Results**     Incidence of low birth weight infant was 7.9 %.  The point that had the best sensitivity and specificity of symphysis-fundus height in the prediction of low birth weight infant was   32 cm. It had 97.4% sensitivity and 72.1% specificity. Receiver Operator Characteristic (ROC) curve of symphysis-fundus height measurement showed that the test had a curve tendency close to the curve of the good test.

**Conclusion**     Symphysis-fundus height measurement seems effective in predicting low birth weight infant, it may be introduced to be one of the routine screening tests in intrapartum care.

**Key words:**     Symphysis-fundus height, low birth weight

Low birth weight is defined as a birth weight of < 2500 g.[1]  It is resulted from either preterm birth or infant of restricted intrauterine growth.[2]  The affected infants may suffer from many conditions, i.e., hypoglycemia, asphyxia, respiratory distress syndrome, and intraventricular hemorrhage.[2]  Perinatal mortality has been found to be significantly increased in low birth weight infants.[3]  Prediction of low birth weight infant before birth is essential to prepare prompt care after delivery. They are usually detected by clinical and ultrasonographic examination during antenatal care. However, some cases may lack of that detection due to poor antenatal services.  Moreover, there are many cases that have no antenatal care or even no known gestational age. Good intrapartum services can repay, even not all, some of these antenatal deficits.  Clinical estimation of fetal weight (Leopold's maneuver) is one of intrapartum screening tests which can lead to ultrasonographic examination and guide immediate obstetrical interventions.[4,5]  Results from previous studies showed that, by clinical estimation, examiners usually overestimated fetal weight in a group of low birth weight infants.[6-8]  Our recent study also found that experience of examiners particularly has

significant effect on the accuracy of clinical fetal weight estimation in the low birth weight group.[8]  The present study is therefore conducted to find out whether quantified external measurement will assist to predict low birth weight infant or not.  Symphysis-fundus height measurement is simple, not invasive, and takes no cost to the patients.  If the test is effective, it may be introduced to be one of screening procedures in intrapartum care that may assist physicians to decide to sonographically scan and give some immediate obstetrical interventions.  Physicians in rural hospitals may also use as a guide to refer these patients to regional centers for better neonatal cares.

## Materials and methods

The study population consisted of 1450 pregnant women admitted for delivery between January 2000 and July 2000 at Thammasat University hospital.  Inclusion criteria were: 1) singleton pregnancy, 2) admission for planned delivery or in early labor, 3) a fetus in longitudinal lie, 4) intact membrane, and 5) gestational age beyond 28 weeks.  Exclusion criteria were: 1) multifetal pregnancy, 2) dead fetus in utero, and 3) fetal anomalies.  After asking for patient's permission, the symphysis-fundus height measurement was encountered at midline from the superior rim of pubic bone to the highest point of uterine fundus.  While measuring, the tape was closely attached to the abdominal wall.  Centimeter labeled side was hidden at time of measurement.  The birth weight was then measured within 20 minutes after delivery.  Of 1500 pregnant women who met inclusion criteria, 50 (3.3 %)

were excluded because either exclusion criteria were met by chance after delivery or the questionnaire records were incomplete.  Sensitivity, specificity, positive, and negative predictive values of the measurements were calculated by using birth weight less than 2500 g as a gold standard.

## Results

Among the 1450 parturients, the mean maternal age was $25.5 \pm 5.2$ years and ranged between 15 and 43 years.  Median of the gravidity was 2 and median of the parity was 1.  Gestational age at delivery averaged $38.2 \pm 2.0$ weeks and ranged between 28 and 43 weeks, consisted of preterm ($28^{th}$ - before $37^{th}$ week) 8.4 percent, term ($37^{th}$- $42^{nd}$ week) 86.7 percent, and postterm (beyond $42^{nd}$ week) 4.9 percent.  The birth weight in the study population averaged $3050 \pm 495$ g (mean $\pm$ SD) and ranged between 1050 and 4900 gram.  There were 114 low birth weight infants (7.9%), 1203 normal birth weight (2500-3999 g) infants (82.9%), and 133 high birth weight ( 4000 g) infants (9.2%).  Calculation for diagnostic performance of symphysis-fundus height measurement at the level of   33 cm in predicting low birth weight infant is shown in Table 1 (to be a representative of the calculation method for all levels of symphysis-fundus measurement).  Sensitivity, specificity, positive, and negative predictive values of varying levels of symphysis-fundus height measurement are shown in Table 2.  Receiver Operator Characteristic (ROC) curve of symphysis-fundus height measurement is shown in Fig. 1.

**Table 1.** Diagnostic performance of symphysis-fundus height measurement at the level of (33 cm in predicting low birth weight infant

| Symphysis-fundus height | Birth weight | | Total | Calculation |
|---|---|---|---|---|
| | < 2500 g | 2500 g | | Sensitivity = 114/114 = 100 % |
| 33 cm | 114 | 648 | 762 | Specificity = 688/1336 = 51.5 % |
| > 33 cm | 0 | 688 | 688 | Positive PV* = 114/762 = 15.0 % |
| Total | 114 | 1336 | 1450 | Negative PV* = 688/688 = 100 % |

* PV = predictive value

**Table 2.** Diagnostic performance of varying levels of symphysis-fundus height measurement in predicting low birth weight infant

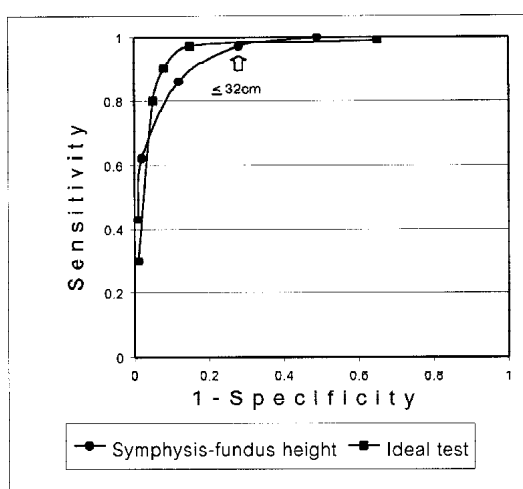| Symphysis-fundus heights | Sensitivity ( % ) | Specificity ( % ) | Positive PV* ( % ) | Negative PV* ( % ) |
|---|---|---|---|---|
| 29 cm | 43.0 | 99.7 | 92.5 | 95.3 |
| 30 cm | 62.3 | 98.0 | 72.4 | 96.8 |
| 31 cm | 86.0 | 88.2 | 38.3 | 98.7 |
| 32 cm | 97.4 | 72.1 | 22.9 | 99.7 |
| 33 cm | 100 | 51.5 | 15.0 | 100 |

* PV = predictive value



**Fig. 1.** Receiver Operator Characteristic (ROC) curve of symphysis-fundus height measurement in predicting low birth weight infant.

## Discussion

There have been limited numbers of published studies about tape measurement at intrapartum period. Walreven GEL, et al studied intrapartum symphysis-fundus measurement in predicting low birth weight in 1509 samples, they found that point of symphysis-fundus height that was recommended to use in clinical practice was 30 cm, it had 66 % sensitivity and 91 % specificity.[9] Pongrojpaw D conducted the study at Ramathibodi hospital and found that intrapartum symphysis-fundus height that had the best sensitivity and specificity in predicting low birth weight infant was 32 cm, it had 97 % sensitivity and 78 % specificity.[10] In the present study, level of

symphysis-fundus height that has the best sensitivity and specificity in predicting low birth weight infant is 32 cm. The explainable reasons for that are ;1) At the levels of 29 cm and 30 cm, there were best specificity found (99.7% and 98.0% respectively), but sensitivity detected from these levels was poor (see Table 2)., 2) At the levels of 31 cm and 32 cm, they produced relatively similar sensitivity and specificity which were relatively good (see Table 2). The author comments that the level of 32 cm is better because it had better sensitivity and fairly acceptable specificity., and 3) At the level of 33 cm, sensitivity was detected the best (100%), but specificity markedly dropped at this level. Taken together, level of symphysis-fundus

height that has the best sensitivity and specificity in predicting low birth weight infant is 32 cm, this finding is consistent with the study of Pongrojpaw D.[10]

How effective is the test? Receiver Operator Characteristic (ROC) curve of symphysis-fundus height measurement (Figure 1) shows that the test has a curve tendency close to the curve of the ideal test. It should thus be assessed that the test is effective. According to limited studies of this measurement in intrapartum period, the author would like to mention some studies about the prediction of low birth weight infant by symphysis-fundus height measurement in antepartum period in order to support this promising association. Wallin A, et al found that serial measurements during antepartum care reflected the fetal growth and correlated well with fetal crown-rump length. In predicting low birth infant, its abnormal curve produced sensitivity and specificity as good as 95% and 93% respectively.[11] Cnattingius S, et al found that normal antepartum serial measurements had 92% specificity in predicting normal birth weight infant, and pathological measurements had 79% specificity in predicting low birth weight infant.[12] Cnattingius S suggested that repeated measurements were able to predict small for gestational age infant.[13] Thompson ML, et al found that fundal height measurement had moderate predictive ability, and suggested that it could be a screening method in predicting low birth weight infant.[14] Results of these studies should suggest that symphysis-fundus measurement is effective in predicting low birth weight infant.

In conclusion, the author suggests that symphysis-fundus height measurement is effective to assist physician's decision other than routine manual estimation alone. The suggested height is 32 cm. Moreover, the test is easy, not invasive, and takes no cost to the patients. This measurement should also be able to be a screening test in intrapartum care.

## References
1. Cunningham FG, Gant NF, Leveno KJ, Gilstrap III LC, Hauth JC, Wenstrom KD, eds. Williams Obstetrics. 21st ed. New York : The McGraw-Hill Companies, Inc, 2001: 5.
2. Behman RE, Kliegman RM, Arion AM. Nelson textbook of pediatrics. 15th ed. Philadelphia: Saunders, 1996: 454-62.
3. Shapiro S, Mc Cormik MC, Starfield BH, Krischer JP, Bross D. Relevance of correlaters of infant deaths for significant morbidity at 1 year of age. Am J Obstet Gynecol 1980;136:363-73.
4. Larsen T, Larsen JF, Petersen S, Greisen G. Detection of small-for-gestational-age fetuses by ultrasound screening in a high risk population: A randomized controlled study, Br J Obstet Gynaecol 1992;99:469-74.
5. Powell SL, Holt VL, Hickok DE, Easterling T, Connell FA. Recent changes in delivery site of low-birth-weight infants in Washington: Impact on birth weight-specific mortality. Am J Obstet Gynecol 1995;173:1585-92.
6. Sherman DJ, Arieli S, Tovbin J, Siegel G, Caspi E, Bukovsky I. A comparison of clinical and ultrasonic estimation of fetal weight. Obstet Gynecol 1998;91: 212-7.
7. Raman S, Urquhart R, Yusof M. Clinical versus ultrasound estimation of fetal weight. Aust N Z J Obstet Gynecol 1992;32:196-9.
8. Kamudhamas A, Torudom P. The ability of medical students in the prediction of birth weight. Thai J Obstet Gynecol 2001;13:91-8.
9. Walraven GEL, Mkanje RLB, Van Roosmalen J, Van Dongen PWJ. Single pre-delivery symphysis-fundal height measurement as a predictor of birth weight and multiple pregnancy. Br J Obstet Gynaecol 1995;102:525 - 9.
10. Pongrojpaw D. Intrapartum symphysis-fundal height measurement in prediction of low birthweight infant. Thammasat Med J 2001;2:32-7 .
11. Wallin A, Gyllensward A, Westin B. Symphysis-fundus measurement in prediction of fetal growth disturbances. Acta Obstet Gynecol Scand 1981;60:317-23.
12. Cnattingius S, Axelsson O, Lindmark G. Symphysis-fundus measurements and intrauterine growth retardation. Acta Obstet Gynecol Scand 1984;63: 335-40.
13. Cnattingius S. Antenatal screening for small-for-gestational-age, using risk factors and measurements of the symphysis-fundus distance-6 years of experience. Early Hum Dev 1988;18:191-7.
14. Thompson ML, Theron GB, Fatti LP. Predictive value of conditional centile charts for weight and fundal height in pregnancy in detecting light for gestational age births. Eur J Obstet Gynecol Reprod Biol 1997;72:3-8.