A Comparison of Clinical and Ultrasound Estimation of Fetal Weight

VITAYA TITAPANT, M.D.*,
SAIFON CHAWANPAIBOON, M.D.*,
KUDKANANG MINGMITPATANAKUL, M.D.*

Abstract

The accuracy of clinical and ultrasound estimation of fetal weight was compared by an analytical cross sectional study. 266 pregnant women who were admitted to the labour room, Siriraj Hospital during the period from February 1, 1999 to March 1, 1999 were included in this study. Fetal weight was estimated in all pregnant women clinically by 2nd year resident physicians and 6th year medical students, followed by ultrasound estimation within 24 hours before delivery. Every estimation was blinded from each other. From the study, clinical estimation by 2nd year resident physicians was comparable with ultrasound estimation and both were significantly more accurate than estimation by 6th year medical students. The proportions of accuracy were 66.7 per cent, 63.3 per cent and 55.3 per cent respectively. Clinical estimation by 2nd year resident physicians tended to have equally over- and underestimation. On the contrary, ultrasound estimation tended to underestimate when the method was inaccurate. Among infants with a birth weight less than 2,500 grams, ultrasound estimation performed slightly better than clinical estimation. However, every method underestimated the fetal weight when an infant weighed more than 4,000 grams. In conclusion, accuracy of clinical estimation of fetal weight by 2nd year resident physicians was comparable to that of ultrasound estimation and may be used as an alternative to ultrasound estimation for pregnant women. However, when the clinical estimate of fetal weight is less than 2,500 grams, ultrasound estimation should be performed for more accurate results and also for assessment of other abnormalities. Careful attention should be paid to infants with a birth weight of more than 4,000 grams since no method can correctly estimate the fetal weight and physicians should be aware of birth trauma.

Key word : Estimation of Fetal Weight, Clinical Estimation, Ultrasound Estimation, Fetal Weight

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* Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Intrauterine fetal weight is one of many important factors used to determine when and how to terminate pregnancy. The ways to estimate fetal weight include clinical and ultrasound estimation[1]. The former is composed of fundal height, size of fetal head and body, and amniotic fluid volume. The measurement of uterine size in transverse and vertical plane are also used to estimate fetal weight[2]. The measurements of biparietal diameter (BPD), abdominal circumference (AC), femur length (FL) and head circumference (HC) by ultrasonography combined with the formula of Shepard[3] or Hadlock[4] are also used to estimate fetal weight.

Clinical and ultrasound estimations of fetal weight have recently been used in many centers. The advantages of clinical estimation are easy and quick without using any instruments. However, there is no standard method, the experience of clinicians is very important. By ultrasound estimation, the anomaly scan can be performed at the same time but ultrasonography is costly and a well-trained ultrasonographer is needed.

Sherman et al[5] reported that 80-85 per cent of clinical estimation of fetal weight is not less or greater than 500 grams of the actual fetal weight and 69 per cent of cases had 10 per cent of inaccurate estimation. Accurate estimation of fetal weight also depends on the range of fetal weight. In the range of less than 2,500 grams, the ultrasound estimation is more accurate than clinical estimation. In the range of 2,500-4,000 grams, clinical estimation is more accurate than ultrasound estimation. In the range greater than 4,000 grams, both methods have shown to have underestimation.

The primary objective of this study was to compare the accuracy of clinical and ultrasound estimation of fetal weight. The secondary objective aimed at comparison of accuracy of clinical estimation for fetal weight between 6th year medical students and 2nd year resident physicians in Siriraj Hospital.

MATERIAL AND METHOD

Two hundred and sixty-six singleton pregnant women who were admitted to the labor room, Siriraj Hospital from February 1, 1999 to March 1, 1999 were enrolled in this study. The pregnant women with intrauterine fetal death, fetal abnormalities and uterine abnormalities were excluded. Fetal weights were clinically estimated in all pregnant women clinically by 2nd year resident physicians and 6th year medical students, followed by ultrasound estimation performed by a well-trained ultrasonographer within 24 hours before delivery. Pregnant women without delivery in 24 hours, with undiagnosed twins and whose fetal biometry was unable to be performed were excluded from this study. The ultrasound measurements included BPD and AC which were used to estimate fetal weight by the Shepard formula[3]. Every estimation was blinded from each other.

Statistical analysis

Continuous data are presented as mean ± standard deviation and range and categorical variables are presented as count and percentage. Comparisons of continuous data between two groups were made by McNemar test and among three groups by Cochran's Q test. The p-value less than 0.05 was considered significant.

RESULTS

Two hundred and thirty-seven from two hundred and sixty-six pregnant women were studied. Twenty-nine pregnant women were excluded because of nondelivery within 24 hours. Basic characteristics of the patients are described in Table 1.

Results of abdominal and per vaginal examination of pregnant women are shown in Table 2. Babies with vertex presentation were found in 94.5 per cent of the pregnant women, longitudinal lie was 97.9 per cent, engagement of fetal head was 71.3 per cent and intact membrane was 75.5 per cent. In cases of intact membrane, amniotic fluid volume was determined by ultrasonographic measurement which revealed 90.5 per cent of cases who had normal amniotic fluid volume, 8.4 per cent had oligohydramnios and 1.1 per cent had polyhydramnios.

All babies had mean neonatal weight of 2,993.33 ± 473 grams (1,340-4,240 grams), 87.8 per cent of the babies had a neonatal weight of 2,500-4,000 grams and 53.6 per cent of the babies were female. According to the modes of delivery, normal deliveries were performed in 68.8 per cent of cases, caesarean section in 27 per cent, vacuum extractions in 3 per cent, forceps extractions in 0.8 per cent, and breech assisting in 0.4 per cent. (Table 3)

Clinical estimation of fetal weight by 2nd year resident physicians and ultrasound estimation

Table 1. Basic characteristics of 237 pregnant women.

Data-based	Number	%
Number of pregnancies		
First pregnancy	117	49.4
Greater than 1st pregnancy	120	50.6
Number of parities		
Primigravida	140	59.1
Multipara	97	40.9
Number of abortions		
No history of abortion	188	79.3
History of abortion ≥ 1	49	20.7
BMI (kilograms/metres^2)		
≤ 25	86	36.3
> 25	151	63.7
Gestational age (weeks)		
28-36	42	17.7
37-40	157	66.2
> 40	38	16.1

Table 2. Results of abdominal and per vaginal examination of pregnant women.

Data-based	Number	%
Presentation		
Vertex	224	94.5
Breech	8	3.4
Others	5	2.1
Fetal lie		
Longitudinal	232	97.9
Transverse	3	1.3
Oblique	2	0.8
Membranes status		
Intact	179	75.5
Rupture	58	24.5
Level of fetal presentation		
Engaged	169	71.3
Unengaged	68	28.7
Amniotic fluid volume (centimeters) *		
< 5 (oligohydramnios)	15	8.4
5-24 (normal)	162	90.5
> 24 (polyhydramnios)	2	1.1

* Performed by using ultrasound measurement only in pregnant women with intact membranes.

were not significantly different. In cases of inaccurate fetal estimation, both clinical estimation by 2nd year resident physicians and ultrasound estimation had a tendency to underestimate the fetal weight. (Table 4)

The accuracy of clinical estimation of fetal weight by 6th year medical students and ultrasound estimation were 55.3 per cent and 63.3 per cent respectively which were not significantly different. In cases of inaccurate fetal estimation, both clinical estimation of fetal weight by 6th year medical student and ultrasound estimation had a tendency of underestimation. (Table 5).

The accuracy of clinical estimation of fetal weight by 2nd year resident physicians and 6th year medical students were 66.7 per cent and 55.3 per cent, respectively which was found to be significantly different. 2nd year resident physicians had both equal chances of under- and over-estimation of fetal weight while 6th year medical students tended to have underestimation of fetal weight. (Table 6)

In the group with neonatal weight less than 2,500 grams, the accuracy of ultrasound estimation and clinical estimation of fetal weight by 2nd year resident physicians and 6th year medical students were 56, 44 and 40 per cent respectively which was not significantly different. (Table 7)

Table 3. Data-base of neonates.

Data-based	Number	%
Range of neonatal weight (grams)		
< 2,500	25	10.5
2,500-4,000	208	87.8
> 4,000	4	1.7
Sex of neonate		
Male	110	46.4
Female	127	53.6
Mode of delivery		
Normal delivery	163	68.8
Caesarean section	64	27.0
Vacuum extraction	7	3.0
Forceps extraction	2	0.8
Breech assistance	1	0.4

In the group with neonatal weight between 2,500 and 4,000 grams, accuracy of ultrasound estimation clinical estimation by 2nd year resident physicians and 6th year medical students were 65.4 per cent, 70.7 per cent and 58.2 per cent respectively. The difference between the accuracy of ultrasound and clinical estimation by 2nd year resident physicians and ultrasound and clinical estimation by 6th year medical students was not significantly different but the difference between the accuracy of

Table 4. Comparison of the accuracy of clinical estimation of fetal weight by 2nd year resident physicians and ultrasound estimation.

	Ultrasound	2nd year resident physicians	P-value*
Accurate estimation (%)	63.3	66.7	0.45
Inaccurate estimation (%)	36.7	33.3	
- underestimation (%)	28.3	17.7	
- overestimation (%)	8.4	15.6	

*McNemar test

Table 5. Comparison of the accuracy of clinical estimation of fetal weight by 6th year medical students and ultrasound estimation.

	Ultrasound	6th year medical students	P-value*
Accurate estimation (%)	63.3	55.3	0.05
Inaccurate estimation (%)	36.7	44.7	
- underestimation (%)	28.3	27.0	
- overestimation (%)	8.4	17.7	

*McNemar test

Table 6. Comparison of clinical estimation of fetal weight by 2nd year resident physicians and 6th year medical students.

	2nd year resident physicians	6th year medical students	P-value*
Accurate estimation (%)	66.7	55.3	0.001
Inaccurate estimation (%)	33.3	44.7	
- underestimation (%)	17.7	27.0	
- overestimation (%)	15.6	17.7	

*McNemar test

Table 7. Comparison of the accuracy of clinical estimation of fetal weight by 2nd year resident physicians and 6th year medical students and ultrasound estimation of the neonatal weight < 2,500 grams.

Group of neonatal weight < 2,500 grams (N=25)	Ultrasound estimation	Clinical estimation by residents	Clinical estimation by students	P-value*
Accurate estimation (%)	56	44	40	0.63
Inaccurate estimation (%)	44	56	60	
- underestimation (%)	20	16	16	
- overestimation (%)	24	40	44	

* Cochran's Q test

Table 8. Comparison of the accuracy of clinical estimation of fetal weight by 2nd year resident physicians, 6th year medical students and ultrasound estimation of neonatal weight between 2,500-4,000 grams.

Group of neonatal weight 2,500-4,000 grams (N=208)	Ultrasound estimation	Clinical estimation by residents	Clinical estimation by students
Accurate estimation (%)	65.4	70.7*	58.2**, ***
Inaccurate estimation (%)	34.6	29.3	41.8
- underestimation (%)	27.9	16.3	26.9
- overestimation (%)	6.7	13	14.9

* The difference between clinical estimation of fetal weight by 2nd year resident physicians and ultrasound estimation was not significant. (P>0.05, Cochran's Q test)

** The difference between clinical estimation of fetal weight by 2nd year residents and 6th year medical students was found to be significant. (P<0.05, Cochran's Q test)

*** The difference between ultrasound estimation of fetal weight and clinical estimation by 6th year medical students was not significant. (P>0.05, Cochran's Q test)

Table 9. Comparison of the accuracy of clinical estimation of fetal weight by 2nd year residents, 6th year medical students and ultrasound estimation of neonatal weight > 4,000 grams.

Group of neonatal weight > 4,000 grams (N=4)	Ultrasound estimation	Clinical estimation by residents	Clinical estimation by students
Accurate estimation (%)	-	-	-
Inaccurate estimation (%)	100	100	100
- underestimation (%)	100	100	100
- overestimation (%)	-	-	-

*Cochran's Q test

clinical estimation of fetal weight by 6th year medical students and 2nd year resident physicians was found to be significantly different. (Table 8)

In the group with neonatal weight greater than 4,000 grams, all estimations were wrong and underestimated. (Table 9)

DISCUSSION

Intrauterine fetal weight is one of many important factors for the management of pregnancy. Some complications including prolonged labour, dystocia and preterm labour during pregnancy are associated with fetal weight, therefore, fetal weight estimation is very useful in the management of pregnancy(6). Clinical and ultrasound estimations of fetal weight have recently been used in many centers. Clinical estimation of fetal weight is easy and no instrument is needed. Ultrasound estimation of fetal weight is costly and well-trained ultrasonographers are needed. Therefore, fetal weight of only high risk pregnancies has been estimated by ultrasound in many centers.

Many studies reported the accuracy of clinical and ultrasound estimation of fetal weight. Some studies concluded that clinical estimation was more accurate than ultrasound estimation but some studies concluded the opposite(5).

This study has shown that clinical estimation by 2nd year resident physicians had at least equal or more accuracy than ultrasound estimation

while the clinical estimation by 6th year medical students had the lowest accuracy compared to the another two methods. This can be simply explained that 2nd year resident physicians have more experience than 6th year medical students and estimate fetal weight by fetal biometry using Shepard formula is still not accurate enough because measurement of the abdominal circumference is one of the major factors for calculation. In cases of ruptured membranes, the abdominal circumference will be very difficult to measures and may lead to underestimation(7,8).

In the group of neonatal weight < 2,500 grams, ultrasound estimation of fetal weight was more accurate than clinical estimation of fetal weight because the high proportion of amniotic fluid volume compared with the fetus causes difficulty in palpation of the fetus(9).

The difference between the error of both ultrasound and clinical estimation of fetal weight was not significant if neonatal weight was between 2,500-3,999 grams. However, 2nd year resident physicians had higher accuracy in estimating fetal weight than 6th year medical students which may result from greater experience of resident physicians.

Neonatal weight greater than 4,000 grams affected the estimation of fetal weight. Under estimation was always found because the incidence of pregnancy with macrosomia was low and the physicians have less experience in this group. Therefore, the clinicians tended to underestimate rather than overestimate which may lead to complications including shoulder dystocia during delivery. More interventions should be performed for the accurate estimation of fetal weight in cases of high risk pregnancy such as diabetes mellitus.

In general, clinical estimation can be used instead of ultrasound estimation, so training for medical students and resident physicians should be encouraged in the training programme. This can lead to early detection of abnormal fetal weight and the proper management of pregnancy.

SUMMARY

Clinical estimation of fetal weight is one of many important skills that general physicians should practice. It is convenient, easy and needs no instruments. Unnecessary ultrasound performance can be reduced due to the general usage of clinical estimation of fetal weight.

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การเปรียบเทียบการคะเนน้ำหนักทารกในครรภ์ด้วยการตรวจทางคลินิกและการตรวจด้วยเครื่องตรวจคลื่นเสียงความถี่สูง

วิทยา ถิฐาพันธ์, พ.บ.,*
สายฝน ชวาลไพบูลย์, พ.บ., คัคณางค์ มิ่งมิตรพัฒนะกุล, พ.บ.**

ทำการศึกษาเพื่อเปรียบเทียบความถูกต้องในการคะเนน้ำหนักทารกในครรภ์ด้วยการตรวจทางคลินิกและการตรวจด้วยคลื่นเสียงความถี่สูงโดยการวิจัยเชิงวิเคราะห์แบบตัดขวางในสตรีตั้งครรภ์ที่รับไว้ในห้องคลอดโรงพยาบาลศิริราช ระหว่าง 1 กุมภาพันธ์ พ.ศ. 2542 ถึง 1 มีนาคม พ.ศ. 2542 จำนวน 266 ราย โดยสตรีตั้งครรภ์ทุกรายจะได้รับการคะเนน้ำหนักทารกในครรภ์ด้วยการตรวจทางคลินิกโดยแพทย์ประจำบ้านชั้นปีที่ 2 และนักศึกษาแพทย์ชั้นปีที่ 6 และโดยการใช้เครื่องตรวจคลื่นเสียงความถี่สูงในระยะเวลาไม่เกิน 24 ชั่วโมงก่อนคลอด ทั้งนี้แพทย์ประจำบ้านและนักศึกษาแพทย์ผู้ตรวจทุกคนจะไม่ทราบผลการคะเนน้ำหนักทารกในครรภ์ของผู้อื่นและวิธีอื่นเลย จากการศึกษาพบว่าการคะเนน้ำหนักทารกในครรภ์ด้วยการตรวจทางคลินิกโดยแพทย์ประจำบ้านชั้นปีที่ 2 มีความถูกต้องใกล้เคียงกับการคะเนน้ำหนักทารกด้วยเครื่องตรวจคลื่นเสียงความถี่สูง และทั้ง 2 วิธีมีความถูกต้องมากกว่าการคะเนโดยนักศึกษาแพทย์ชั้นปีที่ 6 อย่างมีนัยสำคัญ โดยมีความถูกต้องร้อยละ 66.7, 63.3 และ 53.3 ตามลำดับ การคะเนน้ำหนักทารกในครรภ์ด้วยการตรวจทางคลินิกในแพทย์ประจำบ้านชั้นปีที่ 2 มีโอกาสที่จะคะเนได้มากกว่าและน้อยกว่าน้ำหนักทารกจริงในสัดส่วนใกล้เคียงกัน ส่วนการคะเนน้ำหนักทารกในครรภ์โดยการตรวจด้วยเครื่องตรวจคลื่นเสียงความถี่สูง ถ้าการคะเนน้ำหนักไม่ถูกต้อง พบว่ามีการคะเนน้ำหนักทารกในครรภ์ได้ต่ำกว่าน้ำหนักทารกจริง ในกลุ่มที่มีน้ำหนักเมื่อคลอดน้อยกว่า 2,500 กรัม การตรวจด้วยเครื่องตรวจคลื่นเสียงความถี่สูงมีความถูกต้องมากกว่าการคะเนด้วยการตรวจทางคลินิก แต่ในกลุ่มทารกที่มีน้ำหนักทารกเมื่อคลอดมากกว่า 4,000 กรัม ทุกวิธีคะเนน้ำหนักทารกได้ต่ำกว่าน้ำหนักจริง

ผลการศึกษาครั้งนี้สรุปได้ว่า การคะเนน้ำหนักทารกในครรภ์ด้วยการตรวจทางคลินิกโดยแพทย์ประจำบ้านชั้นปีที่ 2 มีความถูกต้องใกล้เคียงกับการคะเนน้ำหนักทารกในครรภ์ด้วยเครื่องตรวจคลื่นเสียงความถี่สูง และอาจใช้แทนเครื่องตรวจคลื่นเสียงความถี่สูงได้ แต่ในรายที่ทารกในครรภ์มีน้ำหนักน้อยกว่า 2,500 กรัม ควรได้รับการตรวจด้วยเครื่องตรวจคลื่นเสียงความถี่สูงเพื่อคะเนน้ำหนักที่ถูกต้อง และตรวจดูความผิดปกติอื่นๆของทารกร่วมด้วย ในกรณีที่ทารกเมื่อคลอดมีน้ำหนักจริงมากกว่า 4,000 กรัม ไม่มีวิธีใดเลยที่สามารถคะเนน้ำหนักได้ถูกต้องและทุกวิธีคะเนน้ำหนักได้น้อยกว่าความจริง จึงควรระมัดระวังอย่างยิ่งเนื่องจากอาจทำให้เกิดอันตรายจากการคลอดได้

คำสำคัญ : การคะเนน้ำหนักทารกในครรภ์, การตรวจทางคลินิก, คลื่นเสียงความถี่สูง, น้ำหนักทารกในครรภ์

วิทยา ถิฐาพันธ์, สายฝน ชวาลไพบูลย์, คัคณางค์ มิ่งมิตรพัฒนะกุล
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* ภาควิชาสูติศาสตร์–นรีเวชวิทยา, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กรุงเทพฯ 10700