
OBSTETRICS

The Feasibility of Extern Training on Ultrasound Fetometry

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ABSTRACT

Objective: To assess the feasibility of a 3-week sonographic training course on estimating gestational age for externs from the Faculty of Medicine, Siriraj Hospital, Mahidol University. Assessment of the gestational age (GA) was obtained from the measurement of bi-parietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL).

Materials and methods: A prospective study was conducted at Pranangkla Hospital. Externs were underwent hands-on practice to measure gestational age according to the second trimester score for gestational age measurement. They were then evaluated by one of the consultant. They were subsequently undertook examination every week. These externs were trained during October 2010 to May 2012. They were assigned as seventeen groups of two and two groups of three. With the total of 40 externs.

Results: During the training period, the highest differences between the gestational ages estimated between the externs and te consultants was t 27.5% at the beginning and declined to 11.5% after the end of first week. All externs could determine the gestational ages without significant differences from the consultants within two weeks with the differences ofe 3.75 and 5.70 in the second- and third-week, respectively.

Conclusion: Extern training on fetal biometry measurements for gestational age estimation within two weeks is feasible and valuable.

Keywords: extern training, gestational age measurement, ultrasound examination

Introduction

Certained gestational age is very important for maternity care, especially in high risk pregnant women with complications such as premature labor pain, intrauterine growth restriction, post term pregnancy, pregnancy induced hypertension and diabetes mellitus. Studies showed that the infant mortality rate was approximately four times higher in those with uncertained gestational age; as a result of too early or late termination of pregnancy⁽¹⁾. These problems can be reduced if precise gestational age is established^(2, 3).

However, using both LMP and uterine size

examination may not enough to establish the precise gestational age. The ultrasonographic examination is more accurate method in the gestational age assessment. For example: it can be performed at any time and place, does not needspecific patient preparation, has low maintenance cost, and is less expensive comparing with other imaging examinations⁽⁵⁻¹³⁾. World Health Organization (WHO) has proposed that the ultrasonographic examination is essential in the care of pregnant women worldwide⁽¹⁴⁾.

Currently, ultrasound machines are accessible in every province and almost all districts of Thailand⁽¹⁵⁾.

However, the physicians who can properly use them are limited because of the lack of training. If undergraduate medical students receive enough basic ultrasonographic training, they should be able to determine the gestational age more accurate.

KAS (K = knowledge, A = attitude, S = skills) are the important elements of learning. Externs usually have knowledge and a good attitude about the ultrasonographic examination. However, they have inadequate skills and have a limited of four-weeks training period in the Department of Obstetrics and Gynecology, Pranangklaao Hospital. We used an innovative model for externs to practice the ultrasonographic examination and used a scoring system to evaluate their performance. The present study was designed to assess the feasibility of a 3-week

sonographic training course to estimate GA for externs form the Faculty of Medicine, Siriraj Hospital, Mahidol University, Thailand.

Materials and Methods

A prospective study was done in 40 externs in Pranangklaao Hospital during October 2010 to May 2012. The second trimester score for gestational age measurement was produced by the author (Fig. 1) to be used for externs' training in the gestational age assessment. It took into account four ultrasound measurements, including bi-parietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) in three weeks.

Table 1. The second trimester score for gestational age measurement

	Weight (%)	Scores
BPD & HC	40	
AC	30	
FL	30	
Total	100	

BPD & HC measurements	Scores
1. Midline perpendicular to ultrasound beam	5
2. Midline equidistant from proximal & distal calvarial margin	5
3. Visualized thalamus	5
4. Visualized cavum septum pellucidum (CSP)	5
5. BPD: outer and inner caliper placement	10
6. HC: caliper placement at outer calvarial margin	10

AC measurement	Scores
1. Round shape AC	5
2. Visualized umbilical vein continuous with 1/3 anterior of portal vein	5
3. Visualized stomach	5
4. Visualized one pair of ribs	5
5. Visualized spine	5
6. Caliper placement at outer skin surface	5

Table 1. The second trimester score for gestational age measurement (Cont.)

FL measurement	Scores
1. Femur perpendicular to ultrasound beam	5
2. Visualized all femur	5
3. Visualized skin margin and soft tissue around femur	5
4. Measure upper femur	5
5. Caliper placement : not include epiphysis	10

BPD = Biparietal diameter, HC = Head circumference, AC = Abdominal circumference, FL = Femur length

Data collection methods

The author designed “the second trimester score for gestational age measurement” by adapting subjective contents from the textbook^(2,3) into objective contents for quantitative comparison. The desired outcome was for externs to be able to perform gestational age measurement accurately by scoring 100 points. This score was sent to the Division of Maternal Fetal Medicine, Department of Obstetrics and Gynecology, Faculty of Medicine, Ramathibodi Hospital to be evaluated and edited into the form as shown in Table 1.

The reason to choose second trimester is because it is the period when the measurement of the four parameters for assessing the gestational age (BPD, HC, AC and FL) has the most reliability^(2, 3, 5-7, 10 -13). After the study was approved by the Ethics Committee of Pranangklaio Hospital, this training course was started

and the numbered were ran from zero, first, second and third weeks. All externs had a pretest on week zero. They were then trained to measure gestational age according to the defined objectives (Fig. 1). The training comprised of seventeen groups of two people and two groups of three people for three weeks during each rotation. Each extern would have about twenty patients per week to scan by themselves. There was one consultant supervised externs once a week for at least 5-10 cases. The author was responsible by teaching basic ultrasound, how to use ultrasonographic machine, pre-test, self-practice and evaluation four times a week. Externs had 30 minutes to measure four parameters (BPD, HC, AC and FL) to estimate the gestational age in each patient. Throughout the study a total of 40 externs were evaluated for 632 times from 158 patients. There were two externs who were not evaluated in the last week.



Fig. 1. Ultrasound examination by extern

After the externs had measured the BPD, HC, AC, FL and collected the images and data from pregnant women; consultant repeated the measurements in the same patients immediately for evaluation. Externs could measure each parameter more than once and selected only the best image for scoring^(3,9,16,17).

Results

From the total of 40 externs, 20% received full

marks (score = 100) in the first week, 65% and 15% got full scores in the second and third week, respectively.

All externs (100%) could measure gestational age according to the defined objectives within three weeks. Among these, 85% were able to do so in two weeks. Even though 15% (six people) of them could not get the score of 100 in the second week, they still achieved high score (95, 95, 95, 90, 90 and 85).

Table 2. Comparing extern scores in each week by using Paired t-test (Dependent t-test)

Extern scores (Mean ± SD)				
scores		Beginning	First week	p
Total	100	56.00 ± 16.88	91.75 ± 7.21	<0.001
BPD + HC	40	22.75 ± 9.87	37.00 ± 4.64	<0.001
AC	30	15.75 ± 6.26	26.25 ± 3.15	<0.001
FL	30	17.50 ± 8.47	28.50 ± 3.04	<0.001
(N = 40)				
scores		First week	Second week	p
Total	100	91.75 ± 7.21	98.75 ± 3.35	<0.001
BPD + HC	40	37.00 ± 4.64	39.50 ± 1.89	<0.001
AC	30	26.25 ± 3.15	29.38 ± 2.02	<0.001
FL	30	28.50 ± 3.04	29.88 ± 0.79	<0.001
(N = 40)				

Table 2. Comparing extern scores in each week by using Paired t-test (Dependent t-test) (Cont.)

scores		Second week	Third week	p
Total	100	98.68 ± 3.43	99.74 ± 1.13	0.088
BPD + HC	40	39.47 ± 1.94	40.00 ± 0.00	0.103
AC	30	29.34 ± 2.07	29.74 ± 1.13	0.324
FL	30	29.87 ± 0.81	30.30 ± 0.00	0.324

(N = 38*)

*N = 38, There were two externs who were not evaluated.

BPD = Biparietal diameter, HC = Head circumference, AC = Abdominal circumference, FL = Femur length

Table 2 compared the scores at the beginning with the first week. It demonstrated that extern scores in the first week were higher than the beginning and showed significant differences in both the total scores and scores by organ ($p < 0.001$). The second week scores were higher than the first week and also showed statistical differences in both the total scores and scores by organ ($p < 0.001$). The third week scores were higher than the second week, but showed no significant

difference in both the total scores and scores by organ ($P > 0.05$).

In conclusion, all externs showed marked improvement in their skills in the first two weeks and could measure the gestational age according to the objective protocol within two weeks. Even though 15% of them did not get full marks in the second week, the data showed no significant difference when compared with the third week ($P > 0.05$).

Table 3. Number of examinations of different GA estimation between externs and staff more than seven days.

Week	BPD (n=40)	HC (n=40)	AC (n=40)	FL (n=40)	Total (n=160)	%
0	9	7	15	13	44	27.50
1	2	5	7	4	18	11.25
2	0	1	1	4	6	3.75
3	3	1	3	2	9	5.92

BPD = Biparietal diameter, HC = Head circumference, AC = Abdominal circumference, FL = Femur length, GA = Gestational age

Table 3 exhibits the number of examination that the difference of GA measurement in each parameters done by the externs and the staff were more than 7 days. The largest difference of the gestational age

estimation between the externs and the staff was 27.5% at the beginning and declined to 11.25%, 3.75% and 5.92% in the first, second and third week, respectively.

Table 4. Gestational age estimation between externs and staff.

	Measured by externs GA (days)	Measured by the staff GA (days)	p
	(X ±SD)		
Beginning			
GA	150.90 ± 26.16	149.73 ± 26.31	0.843
BPD	151.40 ± 27.88	148.20 ± 26.25	0.599
HC	149.10 ± 26.02	149.23 ± 25.36	0.983
AC	149.75 ± 27.83	151.80 ± 28.79	0.747
FL	153.35 ± 26.89	149.70 ± 25.96	0.539
First week			
GA	151.69 ± 19.17	150.41 ± 19.59	0.768
BPD	149.50 ± 17.82	149.75 ± 19.48	0.952
HC	154.08 ± 23.61	150.70 ± 20.41	0.496
AC	152.05 ± 21.13	149.98 ± 19.78	0.652
FL	151.13 ± 20.30	151.20 ± 20.30	0.987
Second week			
GA	154.58 ± 26.83	154.09 ± 25.93	0.934
BPD	153.28 ± 27.52	152.98 ± 26.46	0.960
HC	154.98 ± 27.28	154.53 ± 25.92	0.940
AC	156.18 ± 26.59	154.65 ± 25.17	0.793
FL	153.88 ± 26.52	154.20 ± 26.76	0.957
Third week			
GA	166.91 ± 38.60	166.45 ± 38.50	0.959
BPD	165.26 ± 40.20	164.92 ± 39.20	0.970
HC	166.58 ± 38.55	166.69 ± 38.46	0.995
AC	169.00 ± 39.09	167.66 ± 39.35	0.882
FL	166.79 ± 37.49	166.58 ± 37.96	0.981

BPD = Biparietal diameter, HC = Head circumference, AC = Abdominal circumference, FL = Femur length, GA = Gestational age

Independent t-test was used to assess the difference between staff and externs estimation. If p-value is very close to 1, both estimation are most similar. Table 4 revealed that the p-value was very close to 1 in the third week in all parameters except AC (0.882) and the gestational ages measured by externs and the consultant were not significantly different in every parameter in each week.

Discussion

The purpose of this study was to discern the feasibility of extern training on gestational age

assessment by measuring BPD, HC, AC and FL. There has never been a study about extern training on ultrasonographic examination. This is the first prospective study to train 40 externs by training 2-3 people during each three to four-week period. There were 19 rotations of externs in an overall 18-month period during three academic year (2010-2012). All externs were able to measure the gestational age accurately and most of their abilities are close to the first level of international training⁽¹⁸⁾ as shown in Table 5.

Table 5. Level of skills recognized by RCOG (Royal College of Obstetricians and Gynecologists)⁽¹⁸⁾

First level

1. Confirm intrauterine pregnancy.
 2. Confirm viability.
 3. Determine fetal number.
 4. Undertake fetal measurements to determining gestational age and assess growth.
 5. Determine presentation.
 6. Assess liquid volume.
 7. Note placental site.
 8. Suspect abnormalities relating to the above and seek a second opinion.
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The results of this study showed that “the second trimester score for gestational age measurement” can be used to train externs objectively. Externs acquire the skills to estimate gestational age by measure BPD, HC, AC and FL in only two weeks. This study demonstrated that two externs were able to achieve a score of 100 in the second week and 95 in the third week. There was not statistically different between those who scored between 95-100.

Comparison of measurement gestational age (in days) between externs and consultant at the beginning, the first and second week as in Table 3 by selecting those which were different by more than one week (seven days showed statistically significant), showed a 27.50% difference at the beginning. It decreased to 11.25% and 3.75% in the first and second week respectively. This study found no statistical difference in the third week. Other reports found that gestational age measurement can be done by non-medical personnel including nurses, radiographers and local Karen health workers^(16,17,19,20). Though they could not visualize the images as in the textbook because of their skill; there were errors only in some parameters (BPD, HC, AC and FL) and the measured gestational ages were still reliable^(3, 10, 11, 13).

“The second trimester score for gestational age measurement” is just another training method for extern training to improve their skills to be able to measure BPD, HC, AC and FL with confidence. Supervision from a staff member once a week for at least 5 -10 cases will help them visualize the appropriate images and when

they have confidence; they can learn more.

There are many advantages of using this score in the training. Firstly, the training can be done within a designated period of time. Secondly, the externs can self-study, practice and self-evaluate, track their improvements from their scores, according to the objectives at any period of time. Thirdly, externs who acquire these skills will be able to train others. However, one of the limitations of this method is that they have to have enough time (at least 10 hours) to train and there has to be an appropriate number of ultrasonographic machines for the externs (one machine per 2 externs).

Conclusion

By using “the second trimester score for gestational age measurement” method, we can train and evaluate extern’s skills. Externs developed their skills and could measure GA, BPD, HC, AC and FL comparable to consultant with two week ($p < 0.05$). Estimated gestational age from BPD, HC, AC and FL measurements by externs and the staff were with little differences from 27.50% at the beginning and declined to 11.25% in the first week and only 3.75% in the second week. There was no significant differences in both gestational ages from consultant and externs in each week.

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นักศึกษาแพทย์ชั้นปีที่ 6 กับความสามารถในการตรวจอัลตราซาวนด์

สุรพล ศรีวงศ์พานิช

วัตถุประสงค์: เพื่อศึกษาถึงความเป็นไปได้ในการฝึกอบรมอัลตราซาวนด์ระยะเวลา 3 สัปดาห์ เพื่อให้นักศึกษาแพทย์ปีที่ 6 คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล มีทักษะในการวัดอายุครรภ์ โดยวัดทั้ง biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) และ femur length (FL)

วัสดุและวิธีการ: การศึกษาแบบไปข้างหน้าได้ดำเนินการในโรงพยาบาลพระนั่งเกล้า นักศึกษาแพทย์ปีที่ 6 ได้รับการฝึกการวัดอายุครรภ์ตาม ตารางคะแนนการวัดอายุครรภ์ไตรมาสที่ 2 จากนั้นได้รับการประเมินผลและสอบโดยแพทย์ผู้ประเมินทุกสัปดาห์ นักศึกษาแพทย์ได้รับการฝึกอบรมตั้งแต่เดือนตุลาคม 2553 ถึงเดือนพฤษภาคม 2555 รุ่นละ 2 คน 17 รุ่น รุ่นละ 3 คน 2 รุ่น ทั้งหมด 19 รุ่น รวม 40 คน

ผลการศึกษา: ระหว่างการฝึกอบรมพบว่าความแตกต่างของอายุครรภ์ที่นักศึกษาแพทย์ปีที่ 6 วัดได้จากแพทย์ผู้ประเมินมากกว่า 7 วันมีความแตกต่างมากที่สุดคือร้อยละ 27.5 ในสัปดาห์เริ่มต้นและความแตกต่างลดลงเหลือร้อยละ 11.5 ตั้งแต่สัปดาห์แรก นักศึกษาทั้งหมดสามารถวัดอายุครรภ์ได้ผลไม่แตกต่างจากแพทย์ผู้ประเมินได้ภายในระยะเวลาเพียง 2 สัปดาห์ โดยความแตกต่างลดลงเหลือร้อยละ 3.75 และ 5.70 ในสัปดาห์ที่ 2 และ 3 ตามลำดับ

สรุป: การฝึกอบรมเพื่อให้นักศึกษาแพทย์ปีที่ 6 มีทักษะในการวัดอายุครรภ์ของทารกในครรภ์มารดาภายในระยะเวลา 2 สัปดาห์ มีความเป็นไปได้
