

The Cost Analysis of Ultrasound Screening for Fetal Anomalies

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Abstract :

Objectives : To determine the effectiveness of ultrasound screening for fetal anomalies at different gestational ages and to define an appropriate cost for each ultrasound screening.

Materials and methods : 470 pregnant women participated in our ultrasound screening programme from October 1st, 2002 to September 15th, 2003. 757 scans were appointed throughout the first, second and third trimesters, numbering 240, 257 and 260 scans, respectively. The ultrasound cost were reduced to about 30% of the normal price (800 baht for 2-3 scans).

Results : Out of 757 scans, 7 abnormal fetuses were found. All abnormalities were detected around 18-20 weeks of gestation. No abnormalities were found at other gestational ages. The abnormalities included infantile polycystic kidney, cleft lip, trisomy 13, gastroschisis and 3 cases of echogenic foci of hearts. Using this reduced cost, these pregnant women were easily able to participate in this research programme.

Conclusion : In order to reduce perinatal mortality and morbidity, ultrasound screening for fetal anomalies can be performed between 18-20 weeks gestation. If the fetus is found to be abnormal, proper management and care can be planned before delivery. An important obstacle is the high cost of having a scan performed. Therefore, a reduced cost should be considered to recruit more pregnant women to participate in this policy. A reasonable cost for each ultrasound was found to be 425 baht.

เรื่องย่อ : การวิเคราะห์ค่าใช้จ่ายในการตรวจคัดกรองหาความผิดปกติของทารกในครรภ์ด้วยอัลตราซาวด์

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วัตถุประสงค์ : เพื่อประเมินหาประสิทธิภาพในการตรวจคัดกรองหาความผิดปกติของทารกในครรภ์ด้วยอัลตราซาวด์ในช่วงอายุครรภ์ต่างๆ และประเมินหาค่าใช้จ่ายที่เหมาะสมในการตรวจอัลตราซาวด์แต่ละครั้ง

วิธีการวิจัย : ได้ทำการตรวจคัดกรองสตรีตั้งครรภ์จำนวน 470 คนด้วยอัลตราซาวด์จำนวนทั้งหมด 757 ครั้ง ระหว่างวันที่ 1 ตุลาคม พ.ศ. 2545- 15 กันยายน พ.ศ. 2546 โดยสตรีตั้งครรภ์ทั้งหมดได้รับการส่องตรวจด้วยอัลตราซาวด์จำนวนอย่างน้อย 2 ครั้ง และ 3 ครั้งในบางกลุ่ม โดยพบว่าจำนวนครั้งของการตรวจด้วยอัลตราซาวด์ในช่วงไตรมาสที่

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1, 2 และ 3 มีจำนวน 240, 257 และ 260 ครั้งตามลำดับ

ผลการวิจัย : จากการตรวจคัดกรองด้วยอัลตราซาวด์จำนวน 757 ครั้ง พบทารกที่มีความผิดปกติทั้งหมด 7 คน โดยความผิดปกติทั้งหมดพบในช่วงอายุครรภ์ 18-20 สัปดาห์ ไม่พบความผิดปกติในช่วงอายุครรภ์อื่น ความผิดปกติดังกล่าวได้แก่ ภาวะถุงน้ำที่โต ปากแหว่ง ไครโมโซมคู่ที่ 13 ผิดปกติ ภาวะลำไส้ออกมาอยู่นอกช่องท้อง และการตรวจพบจุดผิดปกติที่กล้ามเนื้อหัวใจ และจากราคาอัลตราซาวด์ที่ลดลง (3 ครั้งในราคา 800 บาท) สตรีตั้งครรภ์สามารถตัดสินใจเข้าร่วมการตรวจอัลตราซาวด์ได้ง่ายขึ้น

สรุป : เพื่อที่จะลดอัตราการตายและพิการของทารกในครรภ์ การตรวจคัดกรองหาความผิดปกติของทารกในครรภ์ควรทำในช่วงอายุครรภ์ 18 - 20 สัปดาห์ ถ้าตรวจพบทารกในครรภ์มีความผิดปกติจะได้วางแผนการดูแลรักษาได้ทัน่วงทีก่อนที่จะทารกจะคลอด ปัญหาสำคัญของการตรวจอัลตราซาวด์คือค่าใช้จ่ายที่สูงในการตรวจแต่ละครั้ง ดังนั้นการลดค่าใช้จ่ายลงย่อมทำให้สตรีตั้งครรภ์ตัดสินใจรับการตรวจคัดกรองด้วยอัลตราซาวด์ง่ายขึ้น และราคาที่เหมาะสมคือ 425 บาท

INTRODUCTION

The ultrasound is a useful tool to screen and diagnose fetal abnormalities during pregnancy. When abnormalities are found, appropriate management can be planned. Perinatal mortality and morbidity can be reduced with early proper management. Moreover, fetal structural normality can be confirmed prior to delivery. The Royal College of Obstetrics and Gynecology suggests that pregnant women have at least 2 scans during pregnancy.¹ However, the high cost of ultrasounds and the high pregnant populations at antenatal care clinics create accessibility problems in Thailand. This study was performed to determine the effectiveness of ultrasound screening for fetal anomalies at the different gestational ages and to define an appropriate cost for each ultrasound, number of screenings, and time of screening.

MATERIALS AND METHODS

The study was prospective. 470 pregnant women participated in this ultrasound screening programme from October 1st, 2002 to September 15th, 2003. All pregnant women were randomly appointed to have ultrasound screening at least 1 time. 757 scans were appointed randomly during the first, second and third trimester, numbering 240, 257 and 260 scans, respectively.

Figure 1 (below) is an illustration of how many ultrasounds women received during each

trimester. Some women had ultrasounds during only 1 trimester, others had them during 2 trimesters and others had them during all three trimesters. Any fetal abnormalities discovered, and the gestational age in which they were found, were also recorded.

RESULTS

From the 240 scans during the 1st trimester, 10 scans were found to have abnormalities with 4 cases of blighted ovums, 2 cases of dead fetus in utero, 2 cases of twin pregnancy and 2 cases of spontaneous incomplete abortion. (Table 1) All 1st trimester abnormalities were found before 12 weeks gestation.

Out of the 257 scans during the 2nd trimester, 7 abnormal fetuses were found. These abnormalities were 1 case of polycystic kidney disease, 1 case of gastroschisis, 1 case of trisomy 13, 1 case of cleft lip and 3 cases of echogenic foci of the hearts were detected around 18-20 weeks of gestation. No abnormalities were found during the 2nd trimester. (Table 2)

Out of 260 scans in the 3rd trimester, 9 cases had abnormalities. 6 cases were previously found in the 2nd trimester and 3 cases were found to be new diagnoses. They were 2 cases of hydrops fetalis and 1 case of ventriculomegaly. (Table 3)

The additional data was analyzed from the assessment cost unit analysis. The cost of ultrasound

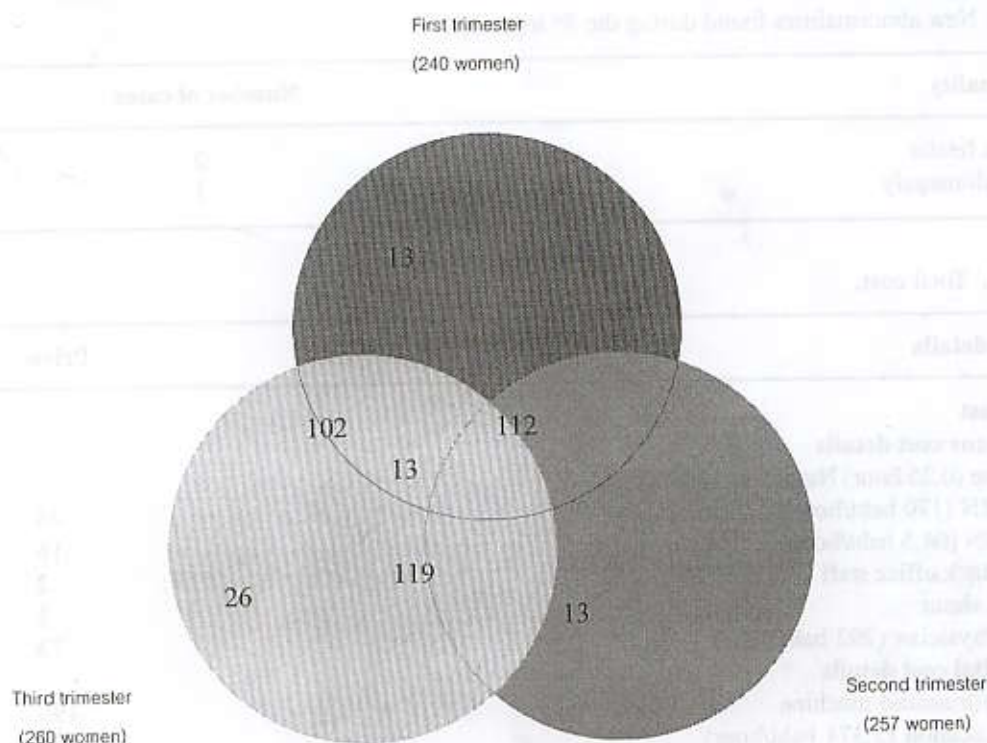


Figure 1. Ultrasound distribution: See explanation in the Materials and Methods section.

Table 1. The abnormalities which were found during 1st trimester.

Abnormality	Number of cases
Blighted ovum	4
Dead fetus in utero	2
Twin pregnancy	2
Spontaneous abortion	2

Table 2. The abnormalities which were found during the 2nd trimester.

Abnormality	Number of cases
Polycystic kidney disease	1
Cleft lip	1
Gastroschisis	1
Trisomy 13	1
Echogenic foci of the hearts	3

Table 3. New abnormalities found during the 3rd trimester.

Abnormality	Number of cases
Hydrops fetalis	2
Ventriculomegaly	1

Table 4. Total cost.

All cost details	Price
Direct cost	
Labour cost details	
(Time (0.25 hour) Numbers (10,028 persons))	
RN (170 baht/hour)	43
PN (64.5 baht/hour)	16
Back office staff	2
Labour	2
Physician (292 baht/hour)	73
Capital cost details	
Ultrasound machine	196
Location (5.374 baht/hour)	1
Random equipment	4
Material cost details	
Dressing set	4
Gel	-
Other materials	-
Indirect cost of department of OB&GYN	17
Indirect cost of faculty of medicine	68
Total cost	425

screening included the direct and indirect costs. The direct cost included labour, capital and materials which are described as in Table 4.

DISCUSSION

The ultrasound is an excellent tool to view anatomical structures, and to screen for soft tissue markers of fetal chromosomal abnormalities and diagnose fetal structural abnormalities. The success of screening and diagnosis is also dependent on the skill of the ultrasonographers, the time of screening and the type of ultrasound machine. Other important

factors include maternal size, gestational age at screening, fetal position and amniotic fluid volume.²⁻⁷

The benefits of first trimester ultrasound screening are to confirm gestational age and early detection of chorionicity of multifetal pregnancy.⁸ Some soft tissue markers of Down's syndrome, including nuchal thickening and congenital heart defects can be detected in this gestational period.^{4,9} The disadvantages of first trimester ultrasound screening include false positive and negative screening tests.^{10,11} Increased nuchal thickening (cystic hygroma) which can be found in the first

trimester, can resolve in the second trimester. Some abnormalities including ventriculomegaly, bilateral hydronephrosis and skeletal abnormalities can not be found in the first trimester but can be detected in the second trimester.^{12,13} Unnecessary abortion and prolonged anxiety of parents may present from first trimester ultrasound screening. Moreover, the high cost (around 800 baht/scan) of ultrasound screening results in its occurrence only in high risk pregnancies. In this study, the abnormalities which were found in the first trimester included blighted ovum, dead fetus in utero and twin pregnancy. All abnormalities can abort spontaneously without early detection. However, the chorionicity of multifetal pregnancy can be clearly seen in this period of gestation, which can assist in proper management plans.

The benefits of second trimester ultrasound screening includes reassuring fetal normality to the parents, as well as detecting some soft tissue markers of chromosomal abnormalities and structural abnormalities.¹⁴⁻¹⁶ This period is the time for parents to prepare if the baby needs surgery or postnatal management.¹⁶ Moreover, the possibility for intrauterine treatment and the option for termination of pregnancy can occur in this period. Most terminated procedures are safe and the all fetus are not viable in this period.¹ The parents can also plan of the mode of delivery, if appropriate.¹

The disadvantage of second trimester ultrasound screening includes the high cost of the scan. Therefore, it can be performed only in high risk groups. Due to false positive and negative results, the prognosis can not be accurately defined. For example, choroid plexus cysts can resolve^{7,11,14} after 24 weeks and many skeletal abnormalities can be clearly detected after 24 weeks of gestation.^{12,13}

However, many abnormalities are clearly detected in the second trimester, especially around 18-20 weeks.^{1,5,6,16} Therefore, the most appropriate

time for pregnant women to have anomaly scan is around 18-20 weeks. While during the third trimester, the growth, amniotic fluid and placental scan can be performed, if the pregnant women can have only one scan, 18-20 weeks gestation is the best period to have it done. If a fetal structural abnormality is found during this time, a follow up scan should be done to avoid a false positive diagnosis. In a normal fetal screening, no additional scan is suggested due to the low incidence of false negative result.

By offering ultrasound at a reduced cost, the pregnant women in our study decided easily to participate. Our assessment cost unit analysis has determined that the appropriated cost should be around 425 baht/scan. At present, the cost is around 800 baht/scan, which results in small numbers of patient being able to participate and probable missed fetal structural abnormalities. Hopefully, the results of this paper will encourage Thai hospitals to adjust the cost of pregnancy ultrasounds. Other factors to determine also include maternal education, insurance coverage, patient compliance and accessibility.

CONCLUSION

To have early detection of fetal structural abnormalities and to produce an ideal plan of management, the anomaly scan could be performed from 18-20 weeks. Many abnormalities can be detected in this period. The cost of this ultrasound should be reduced to around 425 baht/scan.

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