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Determination of Frequency of Ultrasound of Pregnant Women During Routine Pregnancy Monitoring and Evaluation of Knowledge Levels and Expectations About Ultrasonography

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Abstract

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The aim of this study is to determine the frequency of pregnant women having ultrasonography and to evaluate their knowledge and expectations about ultrasonography. Our study included 230 patients who applied to obstetrics and gynecology clinic in a university hospital, who had a pregnancy of 32 weeks or more and agreed to participate in the study. After obtaining the approval of the ethics committee and getting their written consent, a questionnaire consisting of 34 questions was filled by face to face interview method. Pregnant women who were considered to have risky pregnancies in terms of their pregnancies or pre- pregnancy conditions and who need frequent follow-up were not included in the study. The questionnaires were evaluated using the SPSS version 22.0 program. According to the findings obtained from the study, 39.1% of the pregnant women participating in the study think that there is radiation on the ultrasound, just like on a direct radiograph (x-ray). These pregnant women also stated that they know that radiation is harmful for them and their babies. 90% of these pregnant women had ultrasound at each control, and 24.4% had an extra ultrasound to learn the baby's gender. If their doctor is told that it will be enough to do ultrasound four times during pregnancy, 65.6% of the pregnant women reported that they would change their doctor. An ultrasound examination was performed at each control to 90.1% of the pregnant women who stated that the ultrasound was harmful. 27.1% of pregnant women who went to the doctor for extra control for gender think that ultrasound is harmful. 37.3% of pregnant women who had three-dimensional (3D) ultrasound had this done without a doctor's recommendation. Ultrasound should be used in ethically appropriate indications during pregnancy follow-up.

INTRODUCTION

Ultrasonography has been routinely used in obstetric and gynecological examination since 1958[1]. Along with new technologic progresses, ultrasound has obtained an essential feature. Ultrasound has some effects on the surpassed tissues through positive and negative pressure waves. In a 1982 study, it has been shown that early ovulation may occur in ovaries exposed to ultrasound waves[2]. Since this study, there has been an argument on if ultrasound is harmful for the developing follicle, ovum, or the little fetus. While academically studies have been continued, it is commonly accepted that ultrasound bears no risk for the mother and the fetus. Yet, the number of studies analyzing the possible side effects of ultrasounds are limited. Thermal effect (increase in heat) and cavitation are accepted as major biological effects of ultrasound. Heat is caused by energy absorbed by biological tissues after ultrasound exposure. An increase of heat of 2.5°C-5°C has been seen in tissues that were exposed to ultrasound to more than one hour[3]. No increase in intrauterine heat are expected in ultrasound devices used in clinical studies. It is commonly agreed that B-mod visualizations are not contraindicated in human tissues due to thermal reasons. However, doppler equipment used in pregnancy ultrasounds may potentially cause high heat storage between bone and soft tissues[4]. The number of studies evaluating the increase of heat in embryonic and fetal tissues is insufficient. While it has been known that ultrasound has a cavitation effect, there is no in vivo proof in humans. In one study, the cavitations were related with pulmonary hazard in mature rats[5, 6]. The left lung of 50 patients were investigated after routine transesophageal ecocardiography and no effect has been seen[7]. Epidemiological studies has shown no correlation between an increase in ultrasound usage and congenital anomaly[8, 9]. One study researched visual, hearing and growing development in more than 3000 children aged 8-9 years that were exposed to ultrasound in early fetal age. As a result, no correlation between visual or hearing impairment and growing and ultrasound exposure in early fetal age was found[10]. Present data

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show no link between ultrasound usage and fetal anomaly. However, there is no study showing the effects of ultrasound on developing tissues based on the aforementioned biological effects. Therefore, the biological effects of ultrasound after many years should be considered. Unnecessary and protracted ultrasonographic examinations should be avoided.

Besides possible biological effects of ultrasonography, there is an economical extent, especially in developing countries. Every unnecessary and extra ultrasonographic examination is naturally a loss for the economy of the country. Also, a heavy work load for care providers is implied. The cost of an obstetric ultrasound in pregnant women for the healthcare system is approximately 55□. This amount is paid by the Social Security Institution after every obstetric examination using ultrasound. When considered from this point of view, it is obvious that preventing redundant and frequent ultrasonography of enceintes would have a financial contribution.

According to a commonly accepted opinion in obstetrics, it is suggested that pregnant women should be routinely examined via ultrasonographic method in the first 14 gestational weeks, gestational weeks 18-24, 28-32, and 36-38. The aim of these examinations is to make a certain diagnosis of pregnancy, early diagnosis of lost pregnancies, diagnosis of fetal anomalies and evaluation of fetal growth. In the prenatal care management guideline of the Ministry of Health, the aforementioned follow-up periods are recommended[11]. The aim of this study was to evaluate the knowledge of and expectance from routine pregnancy ultrasound in pregnant women and, conclusively, to determine the lacks of knowledge in pregnant women.

MATERIALS and METHODS

Ethical approval

Cumhuriyet University Ethics Committee 15.06.2017 dated decision. Decision number: 2017-06/06

Patient selection and statistical analysis

This study was in a depictive and cross-sectional nature. The population consisted of ≥32 weeks pregnant women applying to an obstetrics and gynecology clinic in a university hospital. Patients that were accepted as gestational or pregestational risky were excluded from the study. The study sample consisted of 230 pregnant women with no gestational risk that applied to the obstetrics and gynecology policlinic between July-December 2017 and accepted to participate in the study. Enceintes that accepted to participate in the study were included via a impropable indiscriminate sampling method. In order to collect data, every pregnant woman was conducted a questionnaire with 34 questions containing information of sociodemographic story, regular pregnancy controls, adaptation to the suggestions of the physician, if ultrasound was performed on every control examination, and if ultrasonography was performed to investigate the gender. The questionnaires were filled by a face-to-face method. The data of our study were uploaded to a SPSS (ver. 22.0) program, and in data analysis, Chi-Square test was used in 2x2 layouts and multispan layouts, and when Chi-Square test assumptions could not be carried out, a Chi-Square value was calculated via a Chi-Square Exact test and reliability coeffecient was set as 0.05. The ethical approval of the study was obtained from the Cumhuriyet University Noninvasive Clinical Research Ethical Committee. The study was conducted in accordance with the Helsinki Declaration, and written and verbal consent was obtained from every participant.

RESULTS

Table 1 shows the definitive features of the pregnant women by number and percentage. Every pregnant woman (n=230) underwent at least one ultrasonographic examination during her pregnancy. While 89.1% (n=205) of the enceintes went to regular pregnancy follow-up visits, it was determined that 10.9% (n=25) did not go to regular pregnancy follow-ups. The reasons why enceintes did not go to regular follow-ups are shown in Table 2. The distribution of pregnant women going to regular follow-ups by institution is shown in Table 3. 85.2% (n=196) of the pregnant women stated that they went to controls according to the suggestions of their doctors, 10% (n=23) went to controls on their own initiative, and 4.8% (n=11) went to controls in case of complaints. Among pregnant women, 95.2% (n=219) stated that they definitely adhered to their doctor's suggestions, while 4.8% (n=11) did not. There was no significant correlation between compliance to doctor suggestions (p=0.408) and educational background (p=0.168). A statistical significant difference in compliance to doctor suggestions between intentional and unintentional pregnancy (p=0.001). 92.2% (n=212) underwent ultrasound in every control visit. 75.7% (n=174) were informed about the date of

control and ultrasound visits. However, among the informed pregnant women, 96.6% (n=168) found the information insufficient. 35.2% (n=81) of the participated enceintes thought that ultrasound is harmful for themselves or their baby. There was no significant correlation between the idea of ultrasound being harmful and educational status (p=0.712) and income status (p=0.875). The sources from where enceintes found that ultrasound is harmful are shown in Table 4. 90.1% (n=73) of the pregnant women speculating that ultrasound is detrimental underwent ultrasonographical examination in every follow-up visit. Of these, 87.7% (n=71) did not share their opinion with their doctor. The answers given to pregnant women that underwent ultrasound at every control visit and shared their opinion on ultrasound being harmful are shown in Table 5. 80% (n=184) of the pregnant women had a detailed (obstetric) ultrasound. The rate of undergoing detailed (obstetric) ultrasound among the participants that thought that ultrasound is harmful was 35.7% (n=69). In 62.6% (n=144) of patients that underwent detailed (obstetric) ultrasound, no consent was obtained and no information was given. While the rate of pregnant women that referred to the doctor as extra in order to learn the gender was 25.7% (n=59), the rate of enceintes that went to routine follow-ups but did not apply to learn the gender was 28.7% (n=66). 27.1% (n=16) of the pregnant women that reffered to a doctor to learn the gender thought that ultrasound is harmful. 33.5% of the enceintes stated that they had the wish from their doctor to spare extra time for gender determination, and of these, 37.7% (n=29) thought ultrasound is detrimental. The rate of enceintes that underwent at least one 3D ultrasound was 36.1% (n=83), and of these, 37.3% (n=31) thought ultrasound is harmful. Reasons why pregnant women underwent a 3D ultrasound are shown in Table 6. 38.7% (n=12) of the pregnant women that had a 3D ultrasound without medical advice thought that ultrasound was harmful. Of the enceintes, 39.1% (n=90) thought that ultrasound emits radiation like x-ray (rontgen) or radiation would be harmful for them and their baby. All of the pregnant women (n=230) stated that they would never undergo x-ray visualization. 40.8% (n=75) of patients that underwent detailed (obstetric) ultrasound, 38.2% (n=81) of those who underwent ultrasound in every follow-up visit, 37.3% (n=22) of those who came to an extra visit for gender determination, and 41% (n=34) of those who had a three-dimensional ultrasound stated that ultrasound emits radiation. Table 7 shows the behaviors of pregnant women that thought ultrasound emits radiation. In case of the doctor's statement that a total of four ultrasonographic examinations is adequate throughout the pregnancy except for emergencies, 67% (n=154) stated that they would not accept it and refer to another doctor, and among these patients, 38.3% (n=59) thought that ultrasound emits radiation.

Table 1. Distribution of pregnant women by depictive features (n=230)

Variable		n(%)
Age		
	17-24	60(26,1)
	25-31	86(37,4)
	32-38	62(26,9)
	≥39	22(9,6)
Working status		
	Employed	190(82,6)
	Unemployed	40(17,4)
Health Insurance		
	Yes	227(98,7)
	No	3 (1,3)
Address		
	City center	151 (65,7)
	County town	48(20,9)
	Rural Area	31(13,5)
Educational status		
	Elementary	137(59,6)
	High school	72(31,3)
	College	21(9,1)
Household Income		
	Low	64(27,8)
	Medium	137(59,6)
	High	29(12,6)
Type of pregnancy		
	Planned	161(70)
	Not planned	69(30)
Number of gestations		
	1	61(26,5)
	2	55(23,9)
	3	51(22,2)
	4	33(14,3)
	≥5	30(13,1)
Number of children		
	None	74(32,2)
	1	55(23,9)
	2	57(24,8)
	3	31(13,5)
	≥ 4	13(5,6)
Number of prenatal follow-ups		
	1	8(3,5)
	2	4(1,7)
	3	3(1,3)
	4	6(2,6)
	≥5	209(90,9)
Follow-up facility		
	University hospital	106(46,1)
	State hospital	108(47,0)
	Primary care clinic	5(2,2)
	Private Hospital	11(4,8)

Table 2. Reasons for irregular follow-ups of pregnant women

Causes	n (%)
I did not have time.	4 (16)
I was not infromed by my doctor.	3 (12)
My address is far from the hospital.	9 (36)
My relative forbid to come to follow-ups.	7 (28)
I cannot get permission from my job.	2 (8)

Table 3: Facilities of pregnant women that adhered to regular follow-ups (n=205)

Follow-up Facility	n (%)
University hospital	100 (94,3)
State hospital	91 (84,3)
Family doctor	3 (60)
Private Hospital	11 (100)

Table 4. Sources pregnant women learned that ultrasound is harmful (n=81)

Sources	n (%)
Gynecologist	10(12,3)
Family doctor	3(3,7)
Internet	8(9,9)
Newspaper, TV, News channel	4(4,9)
"I heard it from my friends."	27(33,3)
"I did not heard it or researched it, but I think that it is harmful."	29(35,8)

Table 5. Answers pregnant women who had an ultrasound in every follow-up visit got when they shared their opinion with their doctor that ultrasound is harmful. (n=10)

Doctor's answers	n (%)
Replied as "it is just harmless".	4(40)
Doctor did not care about my fear and did not reply.	1(10)
Doctor explained in understandable form and took my consent.	4(40)
Doctor informed me but it was not satisfying.	1(10)

Table 6. Reasons why pregnant women had a three-dimensional ultrasound (n=83)

Reasons	n (%)
Take a picture of the unborn offspring	24(28,9)
According to the doctor's suggestion	52(62,7)
Find out the gender	7(8,4)

Table 7: Behavior of pregnant women that thought that ultrasound emits radiation.

Ultrasound behavior of pregnant women	Total n (%)	Pregnant women thinking ultrasound emits radiation n (%)	p value
Detailed (obstetric) ultrasound	184 (80)	75 (40,8)	0,311
Having an ultrasound at every follow-up	212 (92,2)	81 (38,2)	0,325
Extra doctor referral to find out the gender	59 (25,7)	22 (37,3)	0,638
Having a 3D ultrasound	83 (36,1)	34 (41)	0,669
Pregnant women stating that they would change their doctor who suggested that four ultrasounds are adequate throughout the pregnancy	154 (67)	59 (38,3)	0,707

DISCUSSION

Although the questionnaire study was limited, it is used when acquisition of the opinion of many people is needed. Also, answers of the questionnaire is not able to fully explain the thoughts of people and the results may be misunderstood and, hence, biased. Deaths due to pregnancy, birth or postnatal complications are one of the major problems to cope with in developing countries in the short term. Maintaining a healthy pregnancy and, conclusively, achieving healthy babies from healthy mothers is a favored result. This is achieved by pregnancy follow-ups at regular intervals beginning from identification of gestation and the early diagnosis of risky pregnancies and determination of pregnancies under high risk[12]. There is a full consensus on using ultrasonography as screen test on certain gestational weeks. However, it is still discussed if ultrasonography is a part of routine fetal examination. These debates especially rely on the cost and the experience of the examiner[13]. In the Ministry of Health Prenatal Care Management Guideline, it was suggested that the first follow-up should be in the first 14 weeks of gestation, the second during gestational 18th-24th weeks, the third during gestational 28th-32nd weeks, and the fourth during 36th-38th weeks[11]. The primary objectives and periods of ultrasound during pregnancy could be listed as followed[14]:

1) First trimester:

- Definitive identification of gestational age
- Determination of chorionicity and amnionicity in twins
- Identification of structural anomalies due to chromosomal abnormalities and major malformations

2) Second trimester:

- Determination of present malformation and evaluation of fetal anatomy

3) Third trimester:

- Identification of fetal growth limitation
- Evaluation of amnion fluid quantity
- Determination of malformations overlooked at second trimester
- Determination of placental location
- Determination of fetal presentation

One of the most threatening side effect of ultrasound is the possibility of heat increase in developing fetal structures. Under certain conditions, ultrasound may cause increase in heat. Hyperthermia is a well-known teratogenic condition. The nerve system is the tissue most at risk in the fetus, since the neuroblasts do not possess regeneration ability[15]. In a study conducted with rats, there was no increase in prenatal mortality and postnatal defects in rats exposed to ultrasound waves in human dosage[16]. The most common malformations seen in experimental animals under ultrasound exposure are neural tube defects, microphthalmia, cataract and

behavioral problems[17]. It is well-known that structural anomalies increase due to hyperthermia. However, recently, intrauterine hyperthermia has been accepted as a risk factor for schizophrenia[18]. After major ethical theory has been thought and approved, obstetric ultrasound application may only lead to a ethically reasonable conclusion if the indication is based on medical reasoning. Non-medical fetal ultrasound may be accepted as ethically wrong. The ethical analysis of ultrasound is dependent on the period due to fast advancements in ultrasound technology and safety issue which is being accepted as a key determinant in future ethical issues. Moreover, the clearly attractive features of ultrasound (comfort, being non-invasive, painless, immediately informing, no visible physical hazard) may compound ethical issues even more. Though globally extensive studies, it does not seen feasible to exclude theoretical risks of ultrasound to the fetus in near future. The first mission of healthcare professionals is to ensure the ethical rightfulness of obstetric ultrasound under every condition. In this conclusion, the precondition is that extensive and new information on ultrasound safety has been shared with the pregnant women. In our study, 75.7% of the pregnant women (n=174) were informed about the time of follow-up and ultrasound. However, 96.6% of these informed enceintes (n=168) stated that they found the information insufficient. 80% (n=184) of the pregnant women had a detailed (obstetric) ultrasound. Of these, 62.6% (n=144) were not informed or any consent was obtained. Pregnant women should be educated in ultrasound usage and safety in order to change their expectations and perception in a realistic way. Another feature of pregnancy ultrasound that should be noted as least as ethics is the psychosocial aspect. The first environment the couple meets their future baby is ultrasound. This opportunity where the familial emotion will be stiffened should not be wasted. Most pregnant women underwent at least one ultrasound check -up and at least 40% of ultrasounds performed during pregnancy are carried out with obstetric intention[19, 20]. In our study, 100% of the pregnant women (n=230) underwent at least one ultrasound check-up. Many studies have shown that ultrasound during pregnancy is very important for the mothers[21]. The underlying important reasons for this are meeting the baby, realizing the reality of pregnancy and being informed about the fetus' health[22]. Along with these attractive aspects, if the pregnant woman is informed about any problem related with pregnancy during ultrasonographic examination, they may confront shock, concern and disappointment. In studies analyzing the knowledge of women on obstetric ultrasound, it was seen that there was a lack of information in pregnant women in the scale of goals of ultrasound[23], safety levels[24], and diagnostic abilities and limitations[25]. Some studies correlated this situation with the lack of information on ultrasound given to pregnant women[24, 26]. In our study, 75.7% (n=174) of the pregnant women were informed about the times of follow-up and ultrasonographic examination. However, 96.6% (n=168) of the informed pregnant women stated that the information was insufficient. Also, no correlation between the knowledge of women on ultrasound and their educational status was found[27]. In our study, there was no relation between educational status and knowledge on ultrasound (p=0.712). We suggest that this difference may be explained by the convenience of gathering information today. Unnecessary usage of ultrasound should not only be linked with patient knowledge. In a study in the USA, it was shown that more than 30% of the participating doctors being clinical professionals of the ultrasound used obstetric ultrasound without any clinical indication[28]. According to a study in the USA, some pregnant women are afraid that ultrasound might hurt them, while approximately half of them stated that it may be harmful for the baby[29]. According to our study results, 35.2% of the pregnant women thought that ultrasound is harmful for them and their babies. In an English study, 77% of the participants stated that ultrasonographic examination is funny but harmless, while 4% stated to be worried about the hazards. Reasons of concern included fear of harming the fetus and unfavored results of the ultrasound[30]. In a Turkish study, it was found that among pregnant women that underwent ultrasound at every follow-up, blood pressure was never measured in 5%, and complete blood count and urine test was never analyzed in 20%, which all should actually be carried out during pregnancy[31]. However, 100% of these participants were pleased that the doctor made an ultrasound scan at every follow-up. In 1977, the first study on fetal gender determination via ultrasound was published by Stocker and Evens[32]. From this date forward, the curiosity of families to learn the gender of the expected child in the mother's womb has been increasing. Beyond satisfying the parents' curiosity, ultrasonographic fetal gender determination is used in determination of zygozity in twins, determination of X dependent illnesses, determination of pathologies, including testicular feminization[33], evaluation of genetic malformation

dependent unclear genital organs, and prevention of contamination of mother cells during amniocentesis or chorionic villus sampling[34]. In an English study, multiparous mothers were more curious about the gender that mothers in their first pregnancy[35]. In our study, there was no significant difference in curiosity about the gender between multiparous women and patients in their first pregnancy (p=0.984). Women in Turkey accept ultrasonography as a part of prenatal care, independent of the social status. Hence, they regard it as a serious mistake is ultrasound was not used during their follow-up. In the Ministry of Health Prenatal Care Management Guideline, four check-ups via ultrasound during pregnancy were suggested. In our study, when the doctor stated this suggestion to the followed enceinte, 67% (n=154) stated that they would not accept this suggestion and would refer to a check-up by another doctor. In a 1995 Turkish study, the rate of at least one check-up ultrasound scan during pregnancy was found to be 76.6%. However, the study was repeated in 2000 and the rate was found to be 100%[31].

CONCLUSION

In recent situations, it is nearly impossible to convince pregnant women that an ultrasound scan at every follow-up would not ensure an unproblematic pregnancy. This leads to a vicious circle, where doctors are obliged to perform ultrasonographic examination in every antenatal follow-up. In order to get out of this circle, the patient should be informed about the real indications, advantages and limitations of ultrasound. It is vital to form a national ultrasonographic examination protocol, and to ensure complete adaptation.

Conflict of interest

The author declare that they have no conflict of interest.

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