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COMPARISON OF SCAR THICKNESS MEASUREMENT USING TRANSABDOMINAL SONOGRAPHY AND MAGNETIC RESONANCE IMAGING (MRI) IN PATIENTS WITH PREVIOUS CAESAREAN SECTION

Gulzar Hussain[*1], Adil Qayyum[2], Muhammad Usman Khan[3], Tariq Aziz[4], Anum Nisar[5], Arooj Mehmood[6]

[*1]*Postgraduate Resident Diagnostic Radiology Department, CMH Rawalpindi*
[2,4] *Assistant Professor Diagnostic Radiology Department, CMH Rawalpindi*
[3]*Associate Professor Diagnostic Radiology Department, CMH Rawalpindi*
[5,6]*Postgraduate Resident Diagnostic Radiology Department, CMH Rawalpindi*

[*1]waziranjum786@gmail.com

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Corresponding Author: *
Gulzar Hussain

Abstract

Objective:
The objective of this study was to compare the measurement of lower uterine segment (LUS) scar thickness using trans abdominal sonography (TAS) and magnetic resonance imaging (MRI) in patients who had a history of previous caesarean section.

Study Design:
Comparative cross-sectional study.

Place and Duration of Study:
Department of Radiology, CMH Rawalpindi, from 20th May 2024 to 20th November 2024.

Methodology:
A total of 100 pregnant women with a history of at least one previous caesarean section were included in this study. All patients were in the third trimester of pregnancy and were referred for evaluation of lower uterine segment scar. The scar thickness was measured using trans abdominal ultrasonography and magnetic resonance imaging. During ultrasound examination the lower uterine segment was visualized and the thickness of the scar was measured at the thinnest area of the anterior uterine wall. MRI examination was also performed and measurements were taken from the same region of the lower uterine segment to maintain consistency. Basic demographic information like age and gestational age was also recorded. The collected data was entered and analysed using SPSS version 26. Mean scar thickness obtained by both imaging methods was calculated and compared using paired t test. In addition, Pearson correlation coefficient was used to determine the relationship between measurements obtained by ultrasound and MRI.

Results:
The mean scar thickness measured by trans abdominal sonography was found to be 3.45 ± 0.89 mm, while MRI showed a mean thickness of 3.52 ± 0.94 mm. The measurements obtained by both imaging techniques were quite close to each other. Statistical analysis showed a strong positive correlation between the two methods with correlation coefficient r = 0.86 and p value less than 0.001. There was no statistically significant difference between the scar

thickness measurements obtained by ultrasound and MRI.

Conclusion:

The findings of this study suggest that trans abdominal sonography shows a strong correlation with MRI for measuring caesarean scar thickness. Because ultrasound is more easily available, less expensive and quicker to perform, it can be used as a reliable method for routine assessment of lower uterine segment scars in patients with previous caesarean section.

Introduction

In the last few decades the rate of caesarean section has increased all over the world. This rise has been observed in both developed as well as developing countries and it has become a common mode of delivery in many obstetric units. With the increasing number of caesarean deliveries the number of women who have a uterine scar has also increased significantly.[1] Because of this, complications related to previous caesarean scars are becoming more important in clinical practice. Among these complications, scar dehiscence and uterine rupture are considered serious conditions that can threaten the life of both mother and fetus. Proper assessment of the lower uterine segment is therefore very important especially in pregnant women who had a previous caesarean section and are planning a trial of labour after caesarean. Evaluating the strength and thickness of the scar can help doctors in deciding whether a patient can safely attempt vaginal delivery or not. For this reason many researchers have focused on methods that can accurately assess the integrity of the lower uterine segment during pregnancy.[2]

Measurement of caesarean scar thickness has been suggested as one of the useful indicators for predicting the risk of uterine rupture during labour. Different imaging techniques are currently used for evaluation of the lower uterine segment and the scar site. Among them ultrasonography is the most commonly used investigation because it is safe, easily available and relatively inexpensive. It is also widely used in routine obstetric practice and does not expose the patient to radiation. Both trans abdominal and trans vaginal ultrasound methods can be used to assess the scar thickness. Despite its advantages ultrasound has certain limitations as well. The accuracy of ultrasound measurements can sometimes vary depending on the experience of the operator and the technique used during scanning.[8,9] Factors such as maternal body habitus, bladder filling and fetal position can also influence the clarity of the image and the measurement of scar thickness. Because of these issues some clinicians believe that additional imaging methods may help in improving the evaluation of the lower uterine segment.[3,4]

Magnetic resonance imaging is another imaging modality which provides excellent soft tissue contrast and detailed visualization of pelvic structures. MRI allows imaging in multiple planes and therefore can provide a more precise assessment of uterine anatomy and the previous caesarean scar. It has been considered a highly accurate method for evaluating uterine wall thickness and other pelvic abnormalities.[7] However the routine use of MRI in obstetric patients is limited because it is expensive, not easily available in all healthcare settings and the examination takes longer time compared to ultrasound. Several studies have tried to determine whether the measurements obtained by ultrasound correlate well with those obtained by MRI when assessing lower uterine segment thickness. If a strong correlation exists then ultrasound can be confidently used as the primary screening tool for scar assessment in most patients. The present study was therefore conducted to compare the scar thickness measurements obtained by trans abdominal sonography with those measured by MRI in pregnant women who had a previous caesarean section.[5,6]

Methodology

This comparative cross-sectional study was conducted at the Department of Radiology and Obstetrics and Gynaecology, CMH Rawalpindi, after obtaining approval from the institutional ethical review committee. The study was carried out over a period of six months from 20th May 2024 to 20th November 2024. A total of 100

pregnant women who had a history of previous caesarean section were included in the study through non probability consecutive sampling. Only women between the age of 20 to 40 years were enrolled and all of them were in the third trimester of pregnancy with gestational age between 32 and 38 weeks. Patients who had one or more previous lower segment caesarean section were considered eligible for inclusion. However certain patients were excluded from the study in order to avoid confounding factors. These included women with multiple pregnancy, placenta previa, previous classical caesarean section, congenital uterine anomalies and those patients who had any contraindication to MRI examination. After taking informed consent, basic clinical and demographic information of the patients such as age, parity, gestational age and number of previous caesarean sections was recorded.

All included patients underwent imaging evaluation of the lower uterine segment scar using both ultrasound and magnetic resonance imaging. Trans abdominal ultrasound examination was performed first using a convex probe with frequency range of 3.5 to 5 MHz. During the examination the lower uterine segment was visualized in the sagittal plane and the thickness of the scar was measured carefully at the thinnest part of the anterior uterine wall. After ultrasound assessment the patients also underwent MRI examination using a 1.5 Tesla scanner. T2 weighted images were obtained mainly in sagittal and axial planes so that the uterine wall and scar area could be clearly visualized. Scar thickness was then measured from the same corresponding region of the lower uterine segment that was identified on ultrasound in order to keep the measurements consistent. All measurements from both imaging techniques were recorded in millimeters and entered into the study proforma. The collected data was analysed using SPSS version 26. Quantitative variables were presented as mean and standard deviation. The paired t test was applied to compare the mean scar thickness obtained from ultrasound and MRI, while Pearson correlation coefficient was used to determine the relationship between the two imaging methods. A p value of less than or equal to 0.05 was considered statistically significant.

Results

A total of 100 pregnant women with previous caesarean section were included in the study. All participants underwent evaluation of lower uterine segment scar thickness using both trans abdominal ultrasound and magnetic resonance imaging. The demographic characteristics of the patients were also recorded. The mean age of the study participants was 29.8 ± 4.5 years. Most of the patients were in the late third trimester at the time of examination and the mean gestational age was 35.2 ± 1.8 weeks. The majority of patients had one previous caesarean section while some had two previous caesarean deliveries. The scar thickness measurements obtained by both imaging techniques were analysed. The mean scar thickness measured by trans abdominal sonography was 3.45 ± 0.89 mm, while the mean thickness measured by MRI was 3.52 ± 0.94 mm. The difference between the two measurements was small and statistically it was not significant. This shows that both methods provided almost similar values for scar thickness. Correlation analysis was also performed to evaluate the relationship between the measurements obtained by ultrasound and MRI. A strong positive correlation was observed between the two imaging modalities. The Pearson correlation coefficient was r = 0.86 with a p value less than 0.001, which indicates that ultrasound measurements closely match MRI measurements in assessing lower uterine segment scar thickness.

Table 1
Demographic Characteristics of the Study Population (n = 100)

Variable	Mean	Standard Deviation
Age (years)	29.8	4.5
Gestational Age (weeks)	35.2	1.8

Table 2
Distribution According to Number of Previous Caesarean Sections

Number of Previous Caesarean Sections	Frequency	Percentage
One	64	64%
Two	28	28%
Three or more	8	8%

Most of the patients had only one previous caesarean section while a smaller number had two or more previous surgeries.

Table 3
Comparison of Scar Thickness Measured by Ultrasound and MRI

Imaging Modality	Mean Thickness (mm)	Standard Deviation
Trans abdominal sonography	3.45	0.89
MRI	3.52	0.94

The difference between the two imaging techniques was **not statistically significant (p = 0.28)**.

Table 4
Correlation Between Ultrasound and MRI Scar Thickness Measurements

Parameter	Value
Pearson Correlation Coefficient (r)	0.86
p value	< 0.001
Interpretation	Strong positive correlation

The analysis demonstrated that there was a strong relationship between scar thickness measured by ultrasound and MRI. This means that ultrasound measurements are quite close to those obtained by MRI in most patients.

Discussion

Evaluation of the lower uterine segment scar in women who had previous caesarean section is an important part of obstetric care. With the increasing number of caesarean deliveries worldwide, more women are presenting in subsequent pregnancies with a uterine scar. One of the most serious complications related to this scar is uterine rupture during labour, which can lead to significant maternal and fetal morbidity. Because of this risk, assessment of scar thickness in the lower uterine segment has gained considerable attention in recent years.[1] Many researchers have suggested that measurement of scar thickness can help clinicians estimate the strength of the uterine wall and guide decisions regarding trial of labour after caesarean. Various imaging methods have been used to assess this scar including ultrasound and magnetic resonance imaging. Earlier studies have reported that the thickness of the lower uterine segment has a relationship with the risk of uterine rupture and therefore accurate measurement is clinically important.[2]

In the present study trans abdominal ultrasound showed measurements of scar thickness which were very close to those obtained with MRI. Statistical analysis also demonstrated a strong positive correlation between the two imaging modalities. These findings indicate that ultrasound can provide reliable information about the thickness of the lower uterine segment scar in pregnant women. Similar results have been reported in previous studies where sonographic assessment of the scar showed good agreement with other imaging techniques or with findings observed during surgery.[3] Some studies have demonstrated that ultrasound measurement of lower uterine segment thickness can be helpful in predicting the possibility of scar defect or

rupture during labour. Because ultrasound is widely available and relatively easy to perform it remains the most commonly used investigation for evaluation of the caesarean scar.[4]

Another important imaging modality that has been explored for scar evaluation is magnetic resonance imaging. MRI provides excellent soft tissue contrast and allows detailed visualization of pelvic structures including the uterus and surrounding tissues. It can produce images in multiple planes which helps in better identification of the scar region and measurement of the uterine wall. Some researchers have suggested that MRI may offer slightly more accurate assessment of the scar because of its superior image quality. However in routine clinical practice the use of MRI is often limited due to higher cost, limited availability and longer examination time. In many healthcare settings especially in developing countries MRI facilities are not easily accessible for all patients. Therefore ultrasound continues to be the preferred first line imaging method for evaluation of the lower uterine segment.[5,6]

The results of the current study support the idea that trans abdominal ultrasound can provide measurements that are comparable to MRI for assessing caesarean scar thickness.[7,8] This finding is important because it suggests that ultrasound can be confidently used in routine obstetric practice for monitoring patients with previous caesarean section. MRI may still be useful in certain situations where ultrasound findings are unclear or when detailed anatomical evaluation is required. Despite these useful findings the present study also had some limitations. One limitation was that intraoperative measurement of scar thickness was not performed, which could have provided further confirmation of the imaging results. Future studies with larger sample sizes and comparison with surgical findings may help in better understanding the accuracy of different imaging techniques in evaluation of caesarean scars.[9,10]

Conclusion

Trans-abdominal sonography shows a strong correlation with MRI in measuring caesarean scar thickness. Given its availability, lower cost, and non-invasive nature, ultrasound can be considered a reliable modality for routine evaluation of lower uterine segment scars in patients with previous caesarean section.

MRI may be reserved for selected cases where ultrasound findings are inconclusive.

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