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Original Article

Correlation of Gravidity with Cesarean Section Scar Thickness on Ultrasound in Third Trimester of Pregnancy

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ABSTRACT

Background: The correlation between gravidity and cesarean scar thickness is an important consideration in obstetric care, particularly in the context of predicting complications in subsequent pregnancies following a cesarean delivery. Previous studies have provided varied insights, but the relationship remains incompletely understood.

Objective: This study aimed to determine the correlation between gravidity and cesarean section scar thickness as assessed by ultrasound in the third trimester of pregnancy.

Methods: A cross-sectional analytical study was conducted with 100 females from the community, recruited from the University of Lahore Teaching Hospital, Lahore. The study focused on assessing cesarean scar thickness in relation to gravidity. Participants' age ranged from 18 to 44 years. Data were analyzed using statistical methods to determine the correlation between independent variables (age, trimester) and the dependent variable (cesarean section scar thickness).

Results: The mean scar thickness measured by transabdominal ultrasound from 36 to 38 weeks was 3.05 mm. The p-value for the correlation between gravidity and cesarean scar thickness was-0.141, indicating no significant correlation. Additionally, the study found no substantial evidence to suggest that gravidity is a reliable predictor of cesarean scar thickness.

Conclusion: The study concludes that gravidity does not significantly correlate with cesarean scar thickness in the third trimester. This finding underscores the necessity for a more individualized approach in assessing risks associated with VBAC and other pregnancy-related complications in women with a history of cesarean deliveries.

Keywords: Cesarean Scar Thickness, Gravidity, Ultrasound, Third Trimester, Obstetrics, VBAC.

INTRODUCTION

The cesarean section, one of the most common surgical procedures performed by gynecologists, has seen a significant rise in prevalence over recent years. This increase in cesarean deliveries has drawn attention to the management of pregnancies following a prior cesarean, particularly due to the heightened risk of complications in subsequent pregnancies and childbirth. These complications include uterine rupture, scar pregnancy, and placental issues like percreta and accreta (1). Women with a history of cesarean delivery face the choice of attempting a vaginal birth after cesarean (VBAC) or opting for a repeat cesarean delivery.

Assessing the thickness of the cesarean scar is crucial in these situations. A trans-abdominal scan offers a safe, non-invasive, and cost-effective method for this assessment (1). Cesarean delivery rates are particularly high in high-income countries, with 20-35% of all births being via this method. For instance, in England, 27.8% of all births between 2016 and 2017 were cesarean deliveries (2).

Despite a decline in the number of women attempting vaginal births after a previous cesarean, the success rates for VBAC have improved due to better selection of candidates and advancements in ultrasound assessments of uterine scars (3). The indications for cesarean sections have expanded over time, moving beyond the original sole indication of a narrowed pelvis to include various other medical conditions. As a result, maternal and fetal survival rates have improved significantly with the advancement of medical technology and knowledge (3).

Globally, cesarean delivery rates have increased, while VBAC rates have declined (4). However, a labor trial is considered safe for women who have had a previous cesarean section, provided they are appropriately selected, have adequate intrapartum monitoring, and have access to emergency cesarean delivery if necessary (5). While lifesaving, cesarean delivery is a major surgery and can lead

Journal of Health and Rehabilitation Research 2791-156X JHRR

to complications such as hemorrhage, infection, venous thromboembolism, and anesthesia-related issues. Recent reports from well-resourced countries indicate an increase in severe maternal morbidity and mortality, potentially linked to higher cesarean delivery rates, obesity, and older maternal age (6).

Uterine rupture during labor is a serious complication, with symptoms including hypotension, rebound tenderness, tachycardia, and abnormalities in fetal heart-rate. Uterine dehiscence, on the other hand, is usually asymptomatic and often discovered during repeat cesarean sections. Though dehiscence might not have abundant clinical relevance, its early diagnosis is crucial due to its potential to increase the likelihood of intrapartum uterine rupture (7).

Pregnant women with a history of cesarean section face a complex decision regarding their next delivery method, balancing the risks of labor complications against the threat of uterine rupture (8). The increase in elective repeat cesarean deliveries and VBAC attempts significantly contributes to the global rise in cesarean section rates. Uterine rupture, often resulting from the dehiscence of a previous cesarean scar, remains a major concern in these cases (9).

The National Institutes of Health (NIH) statement from 2010 emphasized that labor trials after a cesarean are a safe option for women with a previous cesarean history. Nevertheless, it is crucial to improve the selection process to identify those with a high likelihood of successful VBAC and a low risk of uterine rupture. Conditions like previous classical or inverted T incisions, or a history of uterine rupture, are linked with a higher risk of uterine rupture and are considered contraindications for labor trials after a cesarean (10).

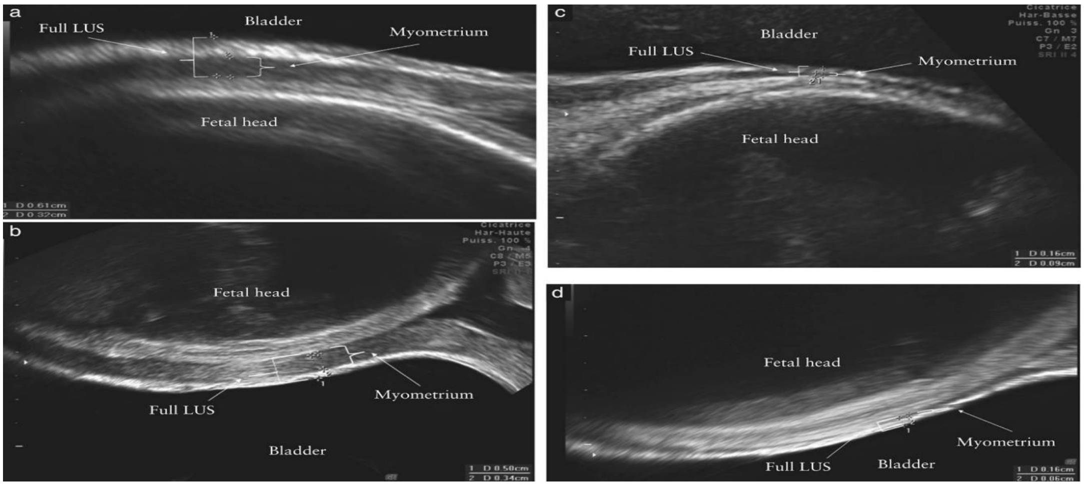

Figure 1 Thickness (a & b) and thinness (c & d)

Thickness (a & b) and thinness (c & d) of lower uterine segment (LUS), myometrium and full lower uterine segment measured and thickness by transabdominal (a) & (c) and transvaginal (b) & (d) ultrasound.

The measurement of myometrial thickness, particularly in the lower uterine segment, is associated with an increased risk of uterine scar rupture. However, opinions differ on the outcomes of measuring myometrial thickness versus the full thickness of the lower uterine segment. Identifying the borders of the myometrial layer in the lower uterine segment can be challenging, potentially affecting the accuracy of these measurements. Cesarean scar thickness is classified into four grades, with Grade 1 being a well-formed scar and Grade 4 indicating a ruptured or dehisced scar (11).

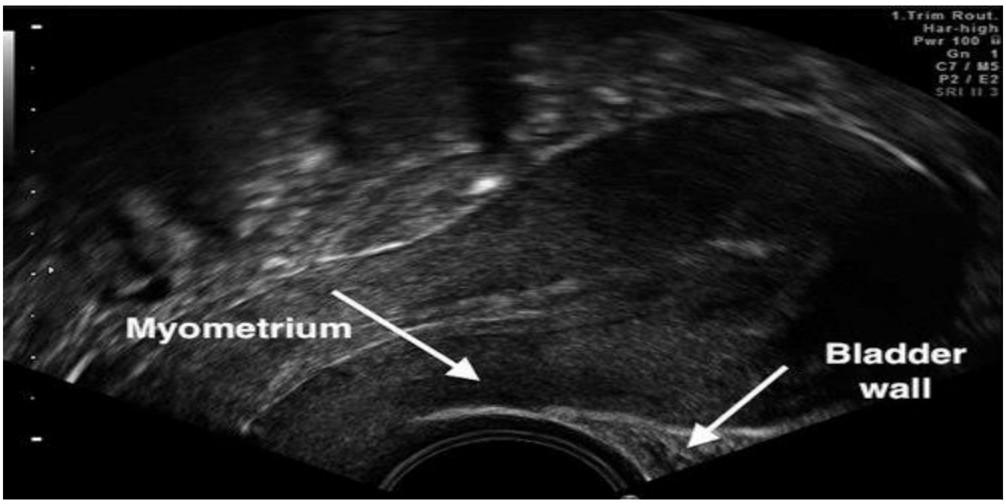

Figure 2 The hypoechoic myometrial muscle and hyperechoic bladder

The hypoechoic myometrial muscle and hyperechoic bladder wall are visible in this normal anteverted uterus.

Various factors influence the risk of uterine scar rupture during labor, including the number of previous cesarean sections, the interval between deliveries, maternal age, prior vaginal deliveries, gestational age, birth weight, and the thickness of the cesarean scar. Studies

Journal of Health and Rehabilitation Research 2791-156X JHRR

suggest a cesarean scar thickness cutoff value between 2-3.5 mm to indicate a lower likelihood of scar rupture during labor (12). Sonographically, the lower uterine segment thickness is typically measured from the outer side, including the bladder muscularis and mucosa, to the inner side, including the chorion-amniotic membrane. This provides an accurate evaluation of the lower uterine segment width and helps identify potential risks of uterine scar rupture during labor (14).

Transabdominal ultrasound generally reports higher cutoff values for predicting uterine scar dehiscence/rupture compared to transvaginal ultrasound. Thus, a combination of both methods is recommended for more accurate detection of scar defects (15). A thin lower uterine segment thickness evaluated by ultrasound in the third trimester is associated with an increased risk of uterine scar rupture or defect in women with a previous cesarean surgery (16).

However, conducting these ultrasounds can be uncomfortable, especially at the end of pregnancy due to the requirement of a full bladder. Therefore, assessing scar thickness before the third trimester or in non-pregnant women is important to identify potential risks of complications related to uterine scar defects (17).

Cesarean section scar thickness in the late third trimester is clinically significant and can be affected by gravidity and multiple cesarean sections. Sonography allows for high-accuracy evaluation of this parameter, and it is crucial to determine the statistical relationship between gravidity and the sonographic appearance of the C-section scar, as well as to identify complications related to uterine scar defects for proper management planning. Therefore, the objective of research was to determine correlation of gravidity with cesarean section scar thickness on ultrasound.

MATERIAL AND METHODS

In the design of this cross-sectional analytical study, researchers focused on examining the relationship between various factors and the thickness of the cesarean section scar. The study was conducted at the University of Lahore teaching hospital, specifically within the Department of Radiology and Medical Imaging Technology, over a period of four months. A total of 100 participants were included in the study, selected through convenient sampling. The inclusion criteria targeted pregnant females with a history of cesarean section delivery, particularly those in their second and third trimesters. Exclusion criteria were carefully defined to omit primigravid females, those without any history of cesarean section delivery, and pregnant females presenting with preexisting pathologies such as placenta previa, placental insufficiency, or other uterine anatomical variants. For the purpose of this study, a Toshiba (xario XG) ultrasound machine equipped with a curvilinear transducer operating at a frequency range of 4–7 MHz was utilized.

The data collection process involved the use of data collection sheets, where information was systematically gathered. Variables such as age, gravidity, trimester, estimated fetal weight, and the duration of pregnancy in weeks were recorded. A particular focus was placed on the cesarean scar thickness and its correlation with gravidity. This data was then meticulously organized and analyzed using Microsoft Excel.

In terms of technique, the sonographic examinations were performed using a 4–7 MHz transabdominal approach. The procedure entailed having the participant in a supine position with a comfortably full bladder, which facilitated a comprehensive evaluation of the entire cesarean scar thickness.

For the data analysis, the study employed SPSS version 25.0. Pearson's correlation was the primary test applied, supplemented by spearman correlation for deeper insights. The analysis involved calculating the mean and standard deviation of the gathered data. By integrating analytical statistics with a descriptive study approach, the research aimed to unearth meaningful correlations and patterns.

The study's findings offer valuable insights into the factors influencing cesarean section scar thickness. By understanding these relationships, medical professionals can better predict potential complications and manage pregnancies following a cesarean section more effectively. This study stands as a significant contribution to the field of obstetrics and gynecology, particularly in the context of prenatal care and cesarean section management.

RESULTS

Table 1 provides a summary of the descriptive statistics for two key variables: age and expected fetal weight (EFW). The study comprised 100 participants, with the age of participants ranging from 18 to 44 years. The average age was 28.32 years, and the standard deviation, indicating the variation in age, was approximately 7.62 years. Regarding expected fetal weight, the range was between 2874 grams and 3499 grams, with an average weight of 3044.68 grams. The standard deviation for EFW was 222.3 grams, reflecting the variability in fetal weights among the participants.

Ali B., et al. (2023). 3(2): DOI: https://doi.org/10.61919/jhrr.v3i2.185
Journal of Health and Rehabilitation Research 2791-156X JHRR

Table 1 Descriptive Statistics

Variable	N	Range	Minimum	Maximum	Mean	Standard Deviation
Age	100	26.00	18.00	44.00	28.32	7.61561
EFW	100	625.00	2874.00	3499.00	3044.68	222.300

Gravidity the bar graph visually represents the distribution of participants by gravidity in the study. It clearly shows that the majority of participants fall within the gravidity range of 2 to 4, with gravidity 3 being the most common at 27%, closely followed by gravidity 2 and 4, at 26% and 23% respectively. There is a notable decrease in the percentage of participants as gravidity increases beyond 4. Gravidity 5 accounts for 17% of the participants, while gravidity 6, 7, and 8 have significantly lower representations, at 4%, 1%, and 2% respectively. This distribution indicates that higher gravidity levels (6 and above) are much less common among the participants in the study.

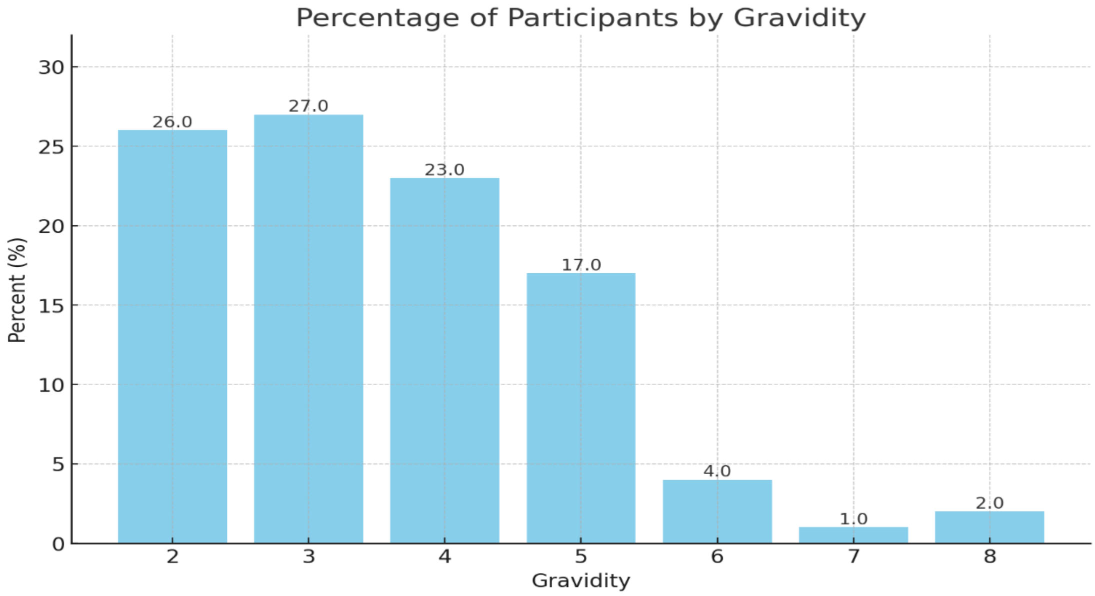

Figure 3 Gravidity The bar graph

Table 2 Cross-Tabulation of Gravidity and Cesarean Scar Thickness

Gravidity	Scar Thickness 2.80 (Count, %)	Scar Thickness 2.90 (Count, %)	Scar Thickness 3.00 (Count, %)	Scar Thickness 3.10 (Count, %)	Scar Thickness 3.20 (Count, %)	Scar Thickness 3.30 (Count, %)	Total (Count, %)
2	1 (3.8%)	6 (23.1%)	4 (15.4%)	11 (42.3%)	1 (3.8%)	3 (11.5%)	26 (100.0%)
3	1 (3.7%)	7 (25.9%)	5 (18.5%)	7 (25.9%)	2 (7.4%)	5 (18.5%)	27 (100.0%)
4	2 (8.7%)	5 (21.7%)	3 (13.0%)	10 (43.5%)	1 (4.3%)	2 (8.7%)	23 (100.0%)
5	0 (0.0%)	4 (23.5%)	0 (0.0%)	8 (47.1%)	2 (11.8%)	3 (17.6%)	17 (100.0%)
6	1 (25.0%)	2 (50.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)
7	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)
8	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (100.0%)
Total	6 (6.0%)	26 (26.0%)	12 (12.0%)	37 (37.0%)	6 (6.0%)	13 (13.0%)	100 (100.0%)
Pearson's p-value: 0.161							

Journal of Health and Rehabilitation Research 2791-156X JHRR

Table 2 presents a detailed cross-tabulation of gravidity against cesarean scar thickness, categorized into six distinct thickness measurements ranging from 2.80 mm to 3.30 mm. Each gravidity level (from 2 to 8) is associated with the frequency and percentage of each scar thickness category. For instance, gravidity 2 shows a higher frequency in the 3.10 mm scar thickness category. In contrast, higher gravidity levels such as 6, 7, and 8 show a tendency towards lower scar thickness measurements. The total column provides an overall distribution of scar thickness across all gravidity levels, with 37% of the observations falling in the 3.10 mm category. The Pearson's p-value of 0.161 suggests that the relationship between gravidity and scar thickness may not be statistically significant.

Table 3 illustrates the relationship between gravidity and cesarean scar thickness. For each gravidity level, the table lists the number of observations (N), the mean scar thickness, the standard deviation (indicating variability), and the minimum and maximum scar thickness observed. As gravidity increases, there appears to be a slight decrease in the mean scar thickness, particularly noticeable at gravidity levels 6, 7, and 8. However, the total mean scar thickness for the entire sample stands at 3.0500 mm.

Table 3 Scar Thickness (mm) by Gravidity

Gravidity	N	Mean	Standard Deviation	Minimum	Maximum
2.00	26	3.0538	0.13336	2.80	3.30
3.00	27	3.0630	0.15229	2.80	3.30
4.00	23	3.0391	0.13731	2.80	3.30
5.00	17	3.1000	0.13693	2.90	3.30
6.00	4	2.9250	0.12583	2.80	3.10
7.00	1	2.9000	-	2.90	2.90
8.00	2	2.8500	0.07071	2.80	2.90
Total	100	3.0500	0.14320	2.80	3.30
Pearson's p-value: 0.141					

The Pearson's p-value of 0.141 in this table indicates a potentially weak correlation between gravidity and scar thickness, warranting further investigation.

DISCUSSION

In this cross-sectional analytical study, we investigated the correlation between gravidity and cesarean section scar thickness as assessed by ultrasound in the third trimester of pregnancy. Despite analyzing data from 100 females from the community, collected at the University of Lahore Teaching Hospital, Lahore, our findings revealed no significant difference. The study utilized statistical analysis to evaluate the data, focusing on independent variables such as age and trimester, and the dependent variable of cesarean section scar thickness, presented in terms of frequency and percentage.

Our results align with those of Sangeeta Ramteke et al., who also observed a correlation between scar thickness measured with TAS and the mode of delivery in patients with a prior cesarean delivery (18). The study by Rao et al. reported an inverse relationship between gestational age and lower uterine segment thickness, a finding consistent with our observations (19). Similarly, Fukuda et al.'s findings about the association between lower uterine segment thickness and intraoperative lower uterine segment thickness in women with prior cesarean delivery, echoed our results, particularly the decrease in thickness with increasing gestational age (20). Conversely, Ram Metal's study did not find gestational age at delivery to be an independent risk factor for the success of VBAC (21). Anadeep Chandi et al.'s research proposed that a thick scar and an inter-pregnancy interval of more than 18 months were associated with more successful outcomes in a trial of labor in women with one prior cesarean delivery, while scars thinner than 2.5 mm were linked to a higher risk of uterine rupture (22).

Baron et al. estimated the incidence of scar dehiscence to be between 0.2% and 4.3% (23). Jastrow et al. highlighted the association of birth weights of 4 kg or more with uterine rupture and other complications (24). Tyagi emphasized the relationship between the number of earlier deliveries and scar dehiscence (25). Landon et al. and Yanxin Wu et al. provided insights into the effect of the duration since the last delivery on the thickness of the lower uterine segment and the risks associated with uterine dehiscence (26, 27).

In our study, the mean scar thickness measured by transabdominal ultrasound from 36 to 38 weeks was 3.05 mm, aligning with Swift et al.'s findings but slightly higher than those reported by Wang et al. (28). Gad et al.'s study also provided valuable comparisons between measurements obtained through transabdominal scans and TVS (29).

Journal of Health and Rehabilitation Research 2791-156X JHRR

The higher incidence of scar dehiscence in our study might be attributed to the limited reach of antenatal services in rural areas and delayed hospital reporting. Factors such as gravidity, gestational period, interpregnancy interval, scar tenderness, scar thickness, and baby weight were all considered to predict scar dehiscence. The patient age ranged from 18 to 44 years, with a mean of 28.32 years and a standard deviation of 7.61 years. Our findings concurred with Maarouf et al. and Kalyankar et al. regarding the mean gestational age and the average age of their study groups (30).

In conclusion, the p-value of cesarean scar thickness in different gravidity groups was -0.141, which was greater than 0.5, indicating no significant correlation between cesarean scar thickness and gravidity. Our study contributes to the growing body of literature on this subject but highlights the need for further research in this area.

CONCLUSION

In conclusion, our study found no significant correlation between gravidity and cesarean scar thickness in the third trimester, as indicated by a p-value greater than 0.5. This finding suggests that gravidity may not be a reliable predictor of cesarean scar thickness, challenging some of the assumptions commonly held in obstetric practice. The implications of this research are significant for clinical decision-making, particularly in the management of pregnancies following a cesarean section. It underscores the need for a more individualized approach when assessing the risks associated with VBAC (Vaginal Birth After Cesarean) and other pregnancy-related complications. Furthermore, our study highlights the importance of considering a range of factors, beyond just gravidity, in predicting cesarean scar integrity, thereby contributing to the safer management of pregnancies in women with a history of cesarean deliveries.

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