Original Research Article

Correlation between ultrasonographic scar thickness and intraoperative uterine scar condition and feto-maternal outcome in patients with previous LSCS

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Abstract

Background: With the increasing global rates of primary cesarean sections, there has been a corresponding rise in the occurrence of repeat cesarean sections. An antenatal ultrasonographic assessment of the lower uterine segment could contribute to the safety of women who are considering a trial of labor by identifying those with a lower risk of uterine rupture. This research aims to investigate the relationship between ultrasonographic scar thickness and the intraoperative condition of the uterine scar, as well as the outcomes for both the mother and the fetus in cases where the patient has previously undergone a lower segment cesarean section (LSCS).

Materials and Methods: Patients of previous caesarian section cases as per inclusion criteria attending to Navodaya Medical College Hospital and Research Centre, Raichur during the study period of 2021-2023 were included in the present study. Patients found to have scar thickness ≥2.5 mm and fulfilling the above mentioned criteria were allowed a trial of labor. Patients with a scar thickness < 2.5mm were taken up for caesarean section and the lower segment was assessed intra-operatively. Obstetric outcomes were studied.

Results: In the present study, it was observed that the majority of patients, 49 (49.0%), belonged to the age group of 25-29 years, followed by 33 (33.0%) in the 20-24 age group, and 14 (14.0%) in the 30-34 age group. Furthermore, the majority of patients, 76 (76.0%), were second gravida. Most patients, 85 (85.0%), were of primi gravida, and again, there was no statistically significant difference in parity found between groups (P>0.05).

The high-risk group experienced a shorter gestational period in comparison to the low-risk group. Notably, 32% of patients in the low-risk group had an inter-delivery interval of 2.5 to 3.5 years, while 60% of patients in the high-risk group had an inter-delivery interval of 1.5 to 2.5 years. NICU admission, required by 3% of newborns, reflects a broader spectrum of health issues that necessitate specialized care beyond standard postnatal care.

Conclusion: Ultrasonographic assessment of LUS is an excellent, non-invasive and cost effective method for safely predicting scar integrity and can be recommended to be routinely incorporated in antenatal workup of a woman with previous caesarean section for deciding on the mode of delivery.

Keywords: Scar thickness, Intraoperative uterine scar, Feto-maternal outcome, Previous LSCS.

1. Introduction

A caesarean section is a frequently performed surgical procedure in obstetrics and is also among the oldest known operations.[1] The classical caesarean section (CS) involves a longitudinal incision in the upper uterine segment, providing a larger space for delivering the baby. However, this method is now rarely used due to its higher risk of complications. Today, the lower uterine segment caesarean section (LSCS) is the most commonly employed technique. This procedure involves making a transverse incision just above the bladder, which results in less blood loss and is easier to repair. Depending on specific conditions such as the presence of lateral varicosities, a constriction ring, or a deeply engaged head, the incision can be transverse, which is typical, or vertical.[2]

In recent years, there has been a significant global increase in caesarean section rates, particularly in developed countries. This rise is attributed to multiple factors, including the growing number of women with previous caesarean deliveries, an increase in multifetal pregnancies, the use of intrapartum electronic fetal monitoring, changes in obstetric training, concerns about medical liability, shifts in parental and societal expectations regarding pregnancy outcomes, and greater maternal autonomy in deciding the mode of delivery.[3]

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Cesarean sections have evolved significantly from being high-risk and restrictive surgeries to procedures that are now considered safe and efficient. With the global increase in primary cesarean section rates, repeat cesarean sections have also become increasingly common. A primary concern during labor in women with scarred uteri is the potential for scar rupture, which can have severe consequences for both the fetus and the mother, including mortality. The primary cesarean rate is around 16%, while the repeat cesarean rate is notably higher at 67%. Globally, approximately 10% of women who have given birth have previously had a cesarean delivery.

Scar rupture may be suspected clinically in cases of fetal distress or a non-reassuring fetal heart rate, maternal tachycardia, severe abdominal pain that persists between contractions, scar tenderness, and excessive vaginal bleeding. Advanced signs include the cessation of uterine activity, hematuria, loss of station of the presenting part, and maternal shock.[4] Sonography can be utilized to assess the integrity of a previous scar and may aid in predicting uterine rupture during labor by evaluating the thickness of the lower uterine segment.[5]

Multiple factors contribute to the risk of uterine scar rupture during labor, including the number of previous lower segment cesarean sections (LSCS), delivery interval, prior vaginal delivery, maternal age, gestational age at delivery, and birthweight.[6] To better evaluate the risk of uterine rupture, some propose using ultrasonographic measurement of the lower uterine segment thickness near term, assuming an inverse correlation between lower uterine segment (LUS) thickness and the risk of uterine scar defects.[7,8] Therefore, antenatal sonographic evaluations of the lower uterine segment may improve safety for women undergoing a trial of labor by identifying those at a lower risk of uterine rupture.

This study aims to establish the relationship between ultrasonographic scar thickness, intraoperative uterine scar condition, and feto-maternal outcomes in patients with a history of lower segment cesarean section (LSCS).

2. Objective

To determine the correlation between ultrasonographic scar thickness and intraoperative uterine scar condition and feto-maternal outcome in patients with previous LSCS.

3. Materials and Methods

Patients of previous caesarian section cases as per inclusion criteria attending to Navodaya Medical College Hospital and Research Centre, Raichur during the study period of 2021-2023 were included in the present study.

3.1. Inclusion criteria

1. Patients with one previous caesarean section
2. Cephalic presentation
3. Gestational age : 38 week of gestation to 42 week of gestation
4. Willing for follow up and delivery at Department of Obstetrics and Gynecology, NMCH& RC, Raichur

3.2. Exclusion criteria

1. All primary cesarean sections.
2. More than one caesarean section.
3. Previous caesarean section done for absolute indication.
4. In addition to previous caesarean, any other uterine surgeries like hysterotomy, myomectomy.
5. Congenital anomalies in baby or uterus.

3.3. Data collection procedure

All eligible candidates, after undergoing a detailed assessment and providing informed written consent for the cesarean section, were closely monitored for both maternal and fetal well-being. The maternal parameters observed included general condition, pulse, blood pressure, uterine contractions, scar tenderness, and vaginal bleeding. Scar tenderness was assessed by gently pressing below and behind the pubic symphysis between uterine contractions while engaging the woman in conversation and observing for any visible signs of discomfort, such as a wince. All the patients were subjected to trans abdominal sonography to determine the scar thickness. An ultrasound machine with a 3.5 MHz transducer was utilized to assess the thickness of the lower uterine segment and detect any abnormalities in that area. The patients were positioned in a supine position on the examination table. After applying gel, the probe was placed on the anterior abdominal wall. The measurement of the anterior wall of the lower uterine segment was taken at the point where it covers the fetal head, specifically from the urine-bladder interface to the interface between the amniotic fluid and the decidua.

For each patient, several measurements of the anterior wall thickness were taken in both the longitudinal and transverse planes, with at least four readings recorded. The smallest value obtained was used to represent the thickness of the lower uterine segment. To evaluate movement, gentle pressure was applied to the maternal abdomen using the transducer, and any movement that caused a distortion of the lower uterine segment was classified as abnormal. Abnormal ultrasound findings included a thin lower uterine segment, ballooning, wedge-shaped defects, abnormal movement, or asymmetry of the lower uterine segment.

All patients were followed up until delivery, whether through cesarean section or vaginal birth. The thickness of the lower uterine segment scar was assessed sonographically between 36 and 38 weeks of gestation and compared with intraoperative findings of scar integrity. Patients with a scar thickness of ≥2.5 mm who met the inclusion criteria were

allowed to undergo a trial of labor. Patients with a scar thickness < 2.5mm were taken up for caesarean section and the lower segment was assessed intra-operatively. Obstetric outcomes were studied.

3.4. Statistical analysis

The data obtained was collected and entered into Microsoft excel spreadsheet. Categorical data was expressed as number and percentages. Continuous data was expressed as mean &standard deviation. Qualitative data on maternal issues during the antepartum, intrapartum, and postpartum periods were evaluated using the test of proportions, with the chi-square test applied to determine statistical significance. Quantitative data were analyzed using the Student's t-test. A p-value of ≤0.05 was considered statistically significant. All statistical analyses were conducted using SPSS software version 21.0.

4. Result

The majority of the study subjects fall within the 25-29 years age range (49%), followed by the 20-24 years range (33%). There are fewer individuals in the 30-34 and 35-39 age ranges (14% and 4%, respectively). Most of the individuals are experiencing their second pregnancy (76%). A smaller percentage is on their third (20%), fourth (3%), or fifth pregnancy (1%). The majority of the individuals have given birth once before (85%), while 13% have given birth twice, and 2% have given birth three times. The gestation period for most individuals is between 38-39 weeks (40%) and 39-40 weeks (33%). A smaller percentage of pregnancies reach 40-41 weeks (24%) and 41-42 weeks (3%). The most common inter-delivery interval is 1.5-2.5 years (36%), followed by 2.5-3.5 years (30%) and 3.5-4.5 years (26%). Longer intervals of 4.5-5.5 years and 5.5 years or more are less common (6% and 2%, respectively).

The most common indications for intervention are postdated pregnancy (20%) and meconium-stained amniotic fluid (MSAF) (19%). Other relatively common indications include oligohydramnios (16%), breech presentation (11%), and pregnancy-induced hypertension (PIH) (10%) followed by, fetal distress (7%), transverse lie (9%), placenta previa (2%), twins (2%), big baby (1%), eclampsia (1%), failed induction (1%), and premature rupture of membranes (PROM) (1%).

Table 1: Basic characteristics

Characteristics	Number	Percentage
Age group (years)		
20 -24	33	33
25 -29	49	49
30 -34	14	14
35 -39	4	4
Gravida		
2nd Gravida	76	76
3rd Gravida	20	20
4th Gravida	3	3
5th Gravida	1	1
Parity		
1st Parity	85	85
2nd Parity	13	13
3rd Parity	2	2
Gestation Weeks		
38 - 39	40	40
39 - 40	33	33
40 - 41	24	24
41 - 42	3	3
Inter Delivery Interval (years)		
1.5 - 2.5	36	36
2.5 - 3.5	30	30
3.5 - 4.5	26	26
4.5 - 5.5	6	6
>= 5.5	2	2

Table 2: Indications of previous caesarean

Indications	Number	Percentage
Big baby	1	1
Breech	11	11
Ecclampsia	1	1
Failed induction	1	1
Fetal distress	7	7
MSAF	19	19
Oligohydramnios	16	16
PIH	10	10
Placenta previa	2	2
Postdated	20	20
Prom	1	1
Transverse lie	9	9
Twins	2	2

Table 3: Delivery related parameters

Parameters	Number	Percentage
Time of previous LSCS		
Elective	41	41
Emergency	59	59
Birth weight (Kg)		
< 2.0	1	1
2.0 - 2.4	9	9
2.5 - 2.9	69	69
3.0 - 3.4	21	21
APGAR score at 1 min		
4	1	1
5	4	4
6	61	61
7	33	33
8	1	1
APGAR score at 5 min		
6	2	2
7	4	4
8	59	59
9	34	34
10	1	1

Table 4: Correlation between ultrasonographic scar thickness and characateristics

Characteristics	USG-Scar Thickness (MM)				p-value
	>= 2.5 mm (Low Risk)		< 2.5 mm (High Risk)		
Age group (years)	Number	%	Number	%	
20 -24	20	31	13	37	
25 -29	31	48	18	51	0.21
30 -34	10	15	4	11	
35 -39	4	6	0	0	

Table 4 Continued…					
Gravida					
2nd Gravida	47	72	29	83	0.44
3rd Gravida	14	22	6	17	
4th Gravida	3	5	0	0	
5th Gravida	1	2	0	0	
Parity					
1st Parity	52	80	33	94	0.15
2nd Parity	11	17	2	6	
3rd Parity	2	3	0	0	
Gestation Weeks					
38 - 39	26	40	14	40	0.55
39 - 40	22	34	11	31	
40 - 41	14	22	10	29	
41 - 42	3	5	0	0	
Inter Delivery Interval (years)					
1.5 - 2.5	15	23	21	60	0.003
2.5 - 3.5	20	32	9	26	
3.5 - 4.5	21	32	5	14	
4.5 - 5.5	6	9	0	0	
>= 5.5	2	3	0	0	

More individuals underwent emergency LSCS (59%) compared to elective LSCS (41%). This indicates that a higher proportion of previous cesarean sections were performed due to urgent or unplanned circumstances. The majority of the babies had a birth weight between 2.5 and 2.9 kg (69%). Smaller percentages of babies fell into the other weight categories, with 21% weighing between 3.0 and 3.4 kg, 9% weighing between 2.0 and 2.4 kg, and only 1% weighing less than 2.0 kg. Most babies had an APGAR score of 6 (61%) or 7 (33%) at 1 minute after birth, indicating that the majority of newborns were in fair to good condition. A small percentage had scores of 4 (1%) or 5 (4%), and only 1% had a score of 8, which is considered good. At 5 minutes after birth, the APGAR scores improved for most babies. The majority had a score of 8 (59%) or 9 (34%), indicating better health conditions compared to the 1-minute scores. A few babies had scores of 6 (2%) or 7 (4%), and only 1% had a perfect score of 10.

In this study, it was found that the largest proportion of patients, 49 (49.0%), were aged between 25 and 29 years, followed by 33 (33.0%) in the 20-24 year age group, and 14 (14.0%) in the 30-34 year age group. No statistically significant difference in age was observed between the low-risk and high-risk groups (P>0.05). Most patients, 76 (76.0%), were second-time mothers, with no significant variation in gravidity between the two risk groups (P>0.05). Additionally, 85 (85.0%) of the patients were first-time mothers, and parity did not differ significantly between the low-risk and high-risk groups (P>0.05).

The high-risk group experienced a shorter gestational period compared to the low-risk group. However, the number of abortions was similar across both groups (P>0.05). Notably, 32% of patients in the low-risk group had an inter-delivery interval of 2.5-3.5 years, whereas 60% of those in the high-risk group had an inter-delivery interval of 1.5-2.5 years. This difference in inter-delivery interval was statistically significant between the low-risk and high-risk groups (P<0.05).

Table 5: Feto-maternal outcome

Outcome	Number	Percentage
Apgar < 7 at 5 min	2	2
NICU admission	3	3

Apgar scores < 7 at 5 minutes are relatively uncommon, occurring in 2% of cases, but indicate significant health concerns that may require intervention.

NICU admission, required by 3% of newborns, reflects a broader spectrum of health issues that necessitate specialized care beyond what is typically provided in standard postnatal care.

5. Discussion

5.1. Age

In our study, the maximum number of patients 49 (49.0%) belonged to the age group of 25-29 years, followed by 33

(33.0%) and 14 (14.0%) belonging to the age groups of 20-24 and 30- 34 respectively and the difference was statistically insignificant. The mean age was 25.97±3.72 years.

In a study conducted by Minakshi M et al,[9] showed that most of the patients were from the age group of 21-25 years. In another study by Vedantham H et al[10] of the total 200, most women (n = 163) were in age group 21-30 years and the mean age of the subjects was 26.3±3.98 years. In a similar study by Dr. Shwetha S et al,[11] majority 44.2% belonged to 26-30 yrs age group and the mean age was 29±4.1 years. Gupta N et al[12] in their study reported that around 72% patients belong to the age group of 21-30years.

5.2. Gravida

In our study, the maximum number of patients 76 (76.0%) were in second gravida and there was no statistical significant difference in the distribution of patients according to gravidity.

5.3. Parity

In our study, the majority of patients, 85 (85.0%), were first-time mothers, with no significant statistical differences observed. This finding is consistent with the research conducted by Dr. Shwetha Setal, which reported that 99 (82.5%) of participants were also first-time mothers.[11]

5.4. Period of gestation

In our study, the average gestational age for both groups was 38.84 weeks. High-risk patients had a shorter gestational period compared to low-risk patients, though this difference was not statistically significant. This is consistent with findings from Minakshi M et al.,[9] who reported a mean gestational age of 38 weeks in both groups, similar to the results of Safia Khalil's study.[13]

5.5. Inter delivery interval

Inter delivery interval was taken as time period from the previous LSCS to the time of conception in months. Study observed that majority of the patients in the low risk group (32%) had inter delivery interval 2.5-3.5 years, 3.5-4.5 years and 60% patients in the high risk group had inter delivery interval of 1.5-2.5 years and the difference was statistically significant.

In a study conducted by Dr. Shwetha S et al,[11] out of 120 women 35 (29.2%) had < 2 years of inter delivery interval and 85 (70.8%) had inter delivery interval of >2 years.

5.6. Indication of previous caesarean:

Fetal distress (28%), post dated (20%), oligohydramnios (15%) and breech (10%) were some of the major indications of previous caesarean among low risk and high risks group. And the difference was statistically insignificant.

In a study conducted by Dhama V et al,[14] major indications observed were fetal distress (22%) and non-progression of labor (19%). In another study Kalyankar B. et al,[15] fetal distress was indicated in 2%, post-datism was in 2%, preeclampsia was in 2%, prolonged PROM responsible for 2% emergency LSCS. Fetal distress and meconium stained liquor were the most common indications for emergency LSCS in studies conducted by Singh N et al[16] and Ganapathi T et al.[17]

5.7. USG scar thickness

In our study, we measured scar thickness using trans-abdominal ultrasound during the third trimester. Among all the features examined, the combination of scar tenderness and third trimester sonographic scar thinning proved to be the best predictors of scar rupture. The mean ultrasound (USG) scar thickness was found to be significantly higher in low-risk patients compared to those in the high-risk group. The mean sonographic LUS thickness in women with abnormal LUS was 2.74±0.44mm. And there was statistically highly significant difference of USG scar thickness among low risk and high risks (P<0.001). This demonstrates that lower the LUS thickness, the higher the risk of scar thinning, dehiscence and rupture. There was no incidence of uterine rupture in our study, and no maternal or perinatal mortality noted.

N Singh et al[16] in their study found that, in the third trimester, scar thickness of less than 2 mm has been linked to an increased risk of scar dehiscence. Ejub Basic et al. found that a thickness of 3.5 mm was the threshold for permitting a successful vaginal delivery in cases of previous cesarean sections.[18] In similar study, Gargy Setal[19] reported scar thickness of 2.1±0.9 mm and Azeem A et al[20] reported 1.9±0.5 mm.

Had sonography been performed later in the third trimester or within one to two weeks of delivery, a thin scar might have been detected. In instances of false negatives, scar tenderness was also absent. This oversight may have occurred due to other factors that favored elective cesarean sections, such as placenta previa, breech presentation, or short stature. This might have obscured the thinned lower uterine segment (LUS) that was present but masked by bladder adhesions.

A cutoff value of 2.5 mm showed a sensitivity of 91.04%, specificity of 72%, positive predictive value of 78.12%, negative predictive value of 96.8%, and overall accuracy of 86%. These findings are consistent with those reported in other studies. In a study, Uharcek P et al. observed a sensitivity of 90.9%, specificity of 84%, positive predictive value of 71.6%, and negative predictive value of 95.9% with a 2.5 mm cutoff.[21] Our study also found that a 2.5 mm cutoff had high sensitivity and a strong negative predictive value. A lower uterine segment (LUS) thickness of ≥2.5 mm suggests a more robust LUS, supporting the option of a trial of labor after a previous cesarean section. However, the positive predictive value of 78.12% implies that not all lower uterine segments below this threshold are necessarily abnormal. An

absolute cutoff value for a completely safe trial of labor has not yet been established.

5.8. Intra operative findings

Study reveals that, in high risk group out of 35 patients, 21 patients had Grade Ichanges, 13 patients had Grade II changes and 1 patients had grade III changes. (15.25%) contributed to the scar dehiscence group (grades III) at the time of repeat caesarean section prior to the onset of labour. There were no reported cases of scar rupture among the patients. The lower uterine segment was evaluated and classified using the grading system developed by Fukuda M. The status of the LUS was recorded by the obstetrician during the cesarean section.[22]

In a study conducted by Vedantham H et al,[10] Grade I lower segment was seen in 99 women, Grade II in 74, Grade III in 18 and Grade IV in 9 women. (13.5%) contributed to the scar dehiscence group (grades III+IV). Grades I and II were considered non–dehiscence group and grades III and IV were considered dehiscence group.

5.9. Birth weight

In our study, majority of 23(66%) belonged to 2.5 to 2.9 kg in high risk group and 46(71%) in low risk group and there was no statistical significant difference of mean birth weight among low risk and high risks (P>0.05). The mean foetal weight is 2.81±0.34 kg.

In a study conducted by Dhama V et al,[14] among 81 babies who delivered by emergency LSCS birth weight was >3 kg in 14 and ≤3 kg in 67 babies and no significance. In another study conducted by Bhakti Kalyankar et al,[15] the mean foetal weight was 2.7±0.9kg similar to our study.

5.10. APGAR score

In this study, 61% of infants had an APGAR score of 6 at 1 minute, while 55% had a score of 7. The difference between these scores was not statistically significant. At 5 minutes, 59% of infants had an APGAR score of 6, and 34% had a score of 7, with no significant difference observed between low-risk and high-risk groups. Dhama V et al. found that the majority of APGAR scores were in the 6-8 range, with fewer scores exceeding 8.[14] Similarly, Gupta N et al[12] in their study noted, 7 neonates were having Apgar score<7 at 5min.

5.11. NICU admission and complications

In our study one baby in low risk group was admitted in NICU in view of fetal distress while 2 babies were admitted in high risk group to NICU for respiratory distress, no babies had complications. No maternal or perinatal mortality was seen in our study.

In a study conducted by Gupta N et al,[12] 4(11.67%) babies were admitted in NICU. Rate of NICU admission was more in repeat LSCS group and reasons for NICU admission was not related to scar thickness.

6. Conclusion

Ultrasonographic measurement of lower uterine segment (LUS) thickness between 36-40 weeks correlates well with intraoperative findings. A thickness of 2.5 mm or less is associated with a higher risk of an abnormal scar. Women with a previous cesarean section and a LUS thickness greater than 2.5 mm may be eligible for a trial of labor after cesarean (TOLAC), assuming no other contraindications. As scar thickness for TOLAC increases, the success rate of VBAC increases.

It is important to spread knowledge regarding regular antenatal check-up, inter delivery interval and training of health care professionals at periphery level for timely referral of these cases to tertiary health care center for appropriate and timely management.

Hence, Ultrasonographic assessment of LUS is an excellent, non-invasive and cost effective method for safely predicting scar integrity and can be recommended to be routinely incorporated in antenatal workup of a woman with previous caesarean section for making decision on the mode of delivery.

7. Source of Funding

None.

8. Conflict of Interest

None.

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