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Comparison of lower uterine segment thickness among pregnant women by transabdominal and transvaginal sonography

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Abstract

Background: Ultrasound is used to evaluate the Lower Uterine Segment, (LUS) especially if there is a previous scar, and it is more beneficial to predict the possibility of the occurrence of any complication during labour such as repeat caesarean section or during trial for vaginal delivery.

Aim: This study aimed to compare the lower uterine segment (LUS) thickness measured by both transvaginal (TVS) and transabdominal ultrasonography (TAS) after completion of 37 weeks of pregnancy with that measured manually using a calliper at the time of caesarean delivery and to determine minimum LUS thickness indicative of its integrity in women who have undergone a previous caesarean section.

Material and Methods: This was a single-centre, hospital-based, cross-sectional study conducted over a period of 18 months by enrolling a total of 120 pregnant women with previous one C-section. All patients were examined by both TAS and TVS to evaluate the thickness of the LUS and the thickness was measured using a vernier calliper intraoperatively.

Results: Of the 120 participants enrolled in the present study- 64 (53.3%) underwent elective LSCS and 56 (46.7%) underwent emergency LSCS. The mean thickness of the LUS as measured by TAS, TVS, and VC was 2.69 mm, 2.25 mm, and 2.22 mm, respectively. As the inter pregnancy interval increased, the thickness of the LUS increased. There were 3 cases of scar dehiscence, all cases were noted among women with scar thickness of < 2 mm on VC.

Conclusion: Transvaginal ultrasonographic measurement of the lower uterine segment in previous LSCS patient is better predictor of LUS thickness in comparison to transabdominal sonography.

Keywords: Caesarean section, sonography, thickness, uterus, scar thickness

Introduction

A Caesarean section, or C-section, is a surgical procedure used to deliver a baby through incisions made in the mother's abdomen and uterus ^[1, 2]. C-sections are generally safe, but like any other surgery, they do carry risks, such as infection, bleeding, and injury to surrounding organs, including the bladder and bowel ^[3, 4]. Women who have had multiple c-sections are at an increased risk of developing placenta previa, placenta accreta, and uterine rupture, potentially causing life-threatening complications for both the mother and baby ^[5].

Scar dehiscence is a rare but potentially serious complication that can occur when the scar from a previous c-section opens up during labour. Scar dehiscence typically occurs at the site of the previous c-section incision and is more likely to occur in women who have had multiple c-sections, particularly if the incisions were made in a vertical rather than horizontal direction ^[6, 7]. It was proposed that the transvaginal ultrasonography's measurement of residual myometrial thickness (from the apex of the uterine scar niche to the serosa) may prove to be a useful technique for predicting obstetric problems in later pregnancy and delivery ^[8]. The possibility of a link between a thinner CS scar in the second and third trimester and uterine rupture or dehiscence in a subsequent pregnancy can provide vital information for planning a pregnant woman's micro plan for birth including place of delivery, elective C-section and need for specialist care ^[9]. It was found that the thickness level as determined by the callipers was closer to the thickness determined by TVS than TAS. To give a trial of labour, the integrity of the LUS's two layers-one of which is a hyper-echogenic layer (the bladder wall) and the other is a hypo-echogenic layer (the uterine myometrium)-should be confirmed sonographically (TAS and TVS) ^[10].

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Materials and Methods

Study Design: This was a single-centre, hospital-based, cross-sectional, observational study.

Study Setting: This study was conducted at the Department of Obstetrics and Gynaecology, MMMCH, Solan, Himachal Pradesh. The present study was conducted after prior approval by the Institute's Ethical Committee (MMMCHIEC21452).

Study Duration: 18 months from January 2022 to April 2023.

Study Outcome: Thickness of the uterine scar measured in millimetres using transabdominal sonography, transvaginal sonography and using the vernier calliper during the C-section.

Study Participants: Pregnant women with one previous C-section fulfilling the following selection criteria.

Inclusion Criteria: Previous one lower segment caesarean section; Gestational age ≥ 37 weeks; Singleton pregnancy. Cephalic presentation; Active labour (cervical dilatation >5 cm).

Exclusion Criteria: Previous 2 or more LSCS; Scar on the uterus other than due to LSCS (e.g., myomectomy, hysterotomy, classical caesarean); Foetal malpresentation; Uterine anomaly; Multiple pregnancies.

Sample Size: A sample size of 120 participants was calculated using the formula for a cross-sectional study assuming a prevalence of 8%.

Sampling Methodology: Non-probability, purposive, and convenience sampling methodology was employed to recruit participants for the present study.

Data Collection: The data were collected in a paper-based proforma. The proforma was approved by the ethical committee before starting data collection.

Study Procedure: USG was done for obstetrical parameters at least a week before expected date of delivery to confirm:

- i) Gestational Age.
- ii) Foetal lie and presentation.
- iii) Placental position.
- iv) **TAS to Assess Scar/LUS Thickness:** This was evaluated in the sagittal section from the midline to lateral ends of scar. The measurement was picked up with cursors placed at the interface of the urinary bladder wall and myometrium and the junction of myometrium chorioamniotic membrane and amniotic fluid in a semi-filled bladder. After that the thinnest zone of LUS was noted in the mid sagittal section.
- v) **TVS:** Urinary bladder was emptied. The bladder was focused in the longitudinal plane of the cervical canal. LUS was seen in two layers, with the bladder inward (seen as echogenic muscosa and mucosa of bladder) followed by hypoechoic myometrium layer. The study participants were placed in a supine position with slightly flexed knees and hips elevated with the help of a pillow and the transducer was gently introduced in the posterior fornix. The images were obtained indifferent planes. Measurements were performed using Philips Affiniti 70G Ultrasound bearing Sr. No. USN17F1419 with Curvilinear probe number C6-2 used for TAS and C9-4v Broadband curved array transducer for TVS, registered under PC-PNDT Act and was performed by the a single sonographer for all the participants.
- vi) Intraoperatively, LUS was identified below the loose vesico-uterine fold and a sterile verniers calliper was used to measure the thickness of LUS after the delivery of fetus and placenta. Two Allis forceps was used in the middle of the lower uterine flap at least 5 centimetres apart and the measurement was noted by vernier calliper. To see the integrity and thickness of LUS intraoperatively, a method devised by Qureshi *et al.* is used and is as follows:

- 1) **Grade I:** A well formed LUS.
- 2) **Grade II:** LUS is thinned out and fetal parts are not visible.
- 3) **Grade III:** Thinned out LUS and fetal parts are visible.
- 4) **Grade IV:** Ruptured or dehiscant LUS.

All measurements (preoperative and intra operative) were charted. Maternal outcome was noted in terms of intraoperative and postoperative complications.

Statistical Analysis Plan: Comparison of continuous variables with baseline values was analysed using a student's t-test in each group. Categorical variables were analysed using chi-square (χ^2) tests^[21]. Spearman's RO correlation coefficient was used to test correlations between three measurement values^[21]. A *P*-value < 0.05 was considered statistically significant.

Results

To recruit participants for the present study, we approached a total of 158 women undergoing caesarean section at our institute. Out of 158 women: 33 did not meet the selection criteria and 5 participants refused to participate in the study and the remaining 120 women were enrolled in the present study.

Table 1: Descriptive characteristics of the participants (n=120)

Age (Years)	n	%
20-24 years	18	15
>24-29 years	47	39.17
>29-34 years	44	36.67
>34-40 years	11	9.17
Mean-29.37 years (± 4.26)		

In the present study, participant's age ranged from a minimum of 20 years to a maximum of 40 years, there were 47 (39.17%) women in the age group of >24 to 29 years and only 11 participants (9.17%) were in the age group of >34-40 years.

Table 2: Obstetrics details of the participants (n=120)

Variable	n	%
Gravida		
G ₂	80	66.67
G ₃	28	23.33
G ₄	12	10.00
Inter-pregnancy Interval		
>18-24 months	29	24.17%
>24-36 months	34	28.33%
>36 months	57	47.5%
History of Abortion		
Yes	40	33.33%
No	80	66.67%

For two-third of the participants it was their second pregnancy, and for 10% of the participants it was their fourth pregnancy. Furthermore, one-third of the participants had a history of abortion. Lastly, the mean inter-pregnancy interval among the participants was 46 months ranging from a minimum of 19 months to 14 years. Of the 120 participants enrolled in the present study- 64 (53.3%) underwent elective LSCS and 56 (46.7%) underwent emergency LSCS.

Table 3 illustrates the mean LUS measured by three techniques according to the inter-pregnancy interval. The mean thickness of the LUS as measured by TAS, TVS, and VC was 2.69 mm, 2.25 mm, and 2.22 mm, respectively. As the inter-pregnancy interval increased, the thickness of the LUS increased.

Table 3: Comparison of LUS thickness by inter-pregnancy interval (n=120)

Inter-Pregnancy Interval	TAS Mean (\pm SD)	TVS Mean (\pm SD)	Vernier calliper Mean (\pm SD)
19-24	2.12 (0.37)	1.71 (0.33)	1.67 (0.35)
25-36	2.69 (0.15)	2.17 (0.14)	2.11 (0.21)
>36	3.06 (0.31)	2.64 (0.29)	2.58 (0.25)
Mean	2.69 (0.49)	2.25 (0.48)	2.22 (0.42)

Table 4 illustrates the distribution of the participants based on the thickness of the LUS as measured by TAS, TVS, and VC. As

Table 4: LUS Thickness as measured on TAS, TVS, and VC

LUS Thickness (mm)	On TAS		On TVS		Vernier calliper	
	n	%	n	%	n	%
1.6-2.5	13	10.83	38	31.67	109	90.83
2.6-3.5	25	20.84	53	44.17	11	9.17
> 3.5-4.5	63	52.5	23	23	0	0
Total	120	15.84	6	15.84	120	100

Most participants (56.67%) had grade II scar thickness measured by Vernier calliper during LSCS, followed by grade I among (27.5%) patients, and Grade III (15.8%). None of the participants had a grade IV scar. There were 3 cases of scar dehiscence, all cases were noted among women with scar thickness < 2 mm on VC.

Discussion

In pregnant women who have previously had a caesarean section, the tissues next to the uterine scar have a tendency to be thinner. It is thought that stretching in a section of the lower uterine segment (LUS) brought on by the gestation itself, which does not occur in the scarred tissue, is what causes the LUS to thin [17]. Scarred tissue is stiff and incapable of stretching. Additionally, the baby head's fall during labour may cause the LUS to become thinner and more stretched, which could result in uterus rupturing. Thus, the LUS thickness can be used to assess the LUS's quality and integrity. Measuring lower uterine segment thickness at term in patient with previous LSCS can help to identify those patients who are at risk of scar dehiscence or rupture.

The mean age of the participants in the present study was 29 years. Similar to our findings, Tekin *et al.*, and Vedantham *et al.*, also reported that the mean age of the participants was 30 years, and 26 years, respectively [18, 19]. In the present study, the mean interpregnancy interval was 46 months, ranging from a minimum of 19 months to 168 months (14 years). Among the comparative studies, the IPI ranged from a minimum of 27 months (Sabaa *et al.*), Singala *et al.*, (51months), Mangala D *et al.*, (43 months) to a maximum of 61 months (Tekin *et al.*) [19-22].

Table 5: LUS Thickness reported by comparative studies

Author	TAS	TVS	VC
Present study	2.69	2.25	2.05
Sen S <i>et al.</i> , [23]	3.13	2.81	3.29
Tekin AB <i>et al.</i> , [18]	4.07	3.28	1.91
Mangla D [20]	NR	2.46	2.35
Mohammad AB [24]	3.7	3.1	NR

Table 5 shows the lower uterine segment thickness as reported by comparative studies. There was significant heterogeneity among the studies reporting the thickness of the lower segment uterine wall. However, among all the reported studies, the

can be inferred from table 3 & 4 the correlation between the thickness of LUS was most close between TVS and VC. The TAS overestimated the thickness of LUS in most patients. There are 23 subjects with scar thickness <2 mm on TVS in comparison 8 subjects had scar thickness < 2 mm on TAS. For most participants (90.83%) the scar thickness measured by Vernier calliper during LSCS was between 1.6-2.5 mm which was most closely associated to the thickness measured by transvaginal ultrasound in 75% of the subjects (p-value < 0.0001).

uterine wall thickness was highest on transabdominal USG and thinnest on VC during the intraoperative period. Existing literature suggests that the measurement of the lower uterine segment using sonography is highly dependent on the skill of the operator, which makes it difficult to standardise procedures. In addition, literature suggests that the thickness of uterine wall is determined by an array of factors including inter pregnancy interval, age of women, parity, number of previous c-sections etc. [25-27]. This can probably explain the difference in the wall thickness reported by various authors.

The rate of scar dehiscence in the present study was 2.5%. Among the comparative studies, the highest rate of scar dehiscence was reported by Mohammad *et al.*, (28%) followed by Mangla *et al.*, (13.5%) and lowest rate was reported by Sen S *et al.*, (2.82%) and Tekin *et al.* (0%) [20, 23, 24]. Swift BE *et al.*, from their systematic review of 28 observational studies reported that the rate of scar dehiscence was 6.2% (361 women: 55 had emergent cesarean and 304 had elective cesarean section) [27].

Conclusion

Based on the empirical data collected and analysed for the present study, transvaginal sonography is better than transabdominal sonography at accurately detecting the thickness of lower uterine segment. When the clinical requirements for Trial of labour are satisfied, a lower uterine segment thickness >3.5 mm is likely safe. Women who are more likely to experience uterine dehiscence/rupture are likely identified by lower uterine segment thickness of 2 mm or less. Lower uterine segment thickness should be utilised as an extra tool to help the woman and her healthcare practitioner make an informed decision, but ultimately, the decision for Trial of labour rests with the woman and her healthcare provider.

Conflict of Interest

Not available

Financial Support

Not available

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