

Scar thickness measurement by transvaginal sonography in late second trimester and third trimester in pregnant patients with previous cesarean section: does sequential change in scar thickness with gestational age correlate with mode of delivery?

Nilanchali Singh · Reva Tripathi · Y. M. Mala ·
Rashmi Dixit

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Abstract

Purpose The objective of this study was to evaluate whether scar thickness measured by transvaginal sonography and the sequential change in scar thickness from second to third trimester has any association with mode of delivery in patients with previous cesarean.

Methods Pregnant women with previous one cesarean section underwent transvaginal sonography between 24 and 28 weeks of gestation and then a repeat scan beyond 36 weeks of gestation to measure scar thickness. These scar thickness measurements were then correlated with the mode of delivery. The scar was measured at multiple sites (3–4) of the lower uterine segment and its thinnest portion was considered to be the scar.

Result Scar thickness was thinner in those patients having cesarean delivery than those having vaginal delivery and this difference was statistically significant at both the gestational ages. Mean scar thickness at 24–28 weeks of

gestation in patients who delivered vaginally is 4.8 ± 1.1 mm and in those who had repeat cesarean section is 4.4 ± 1.1 mm (p value = 0.043). Mean scar thickness beyond 36 weeks of gestation in patients who delivered vaginally is 3.3 ± 0.7 mm and in those who had repeat cesarean section is 2.9 ± 0.9 mm (p value = 0.003). The mean decrease in scar thickness was not significantly different between those who delivered vaginally (mean decrease = 1.73 ± 0.95 mm) and those who had a repeat cesarean (mean decrease = 1.91 ± 0.96 mm).

Conclusion Our study concluded that thicker scars are associated with better chances of successful vaginal birth after cesarean. Measurement at both late second trimester and third trimester can be done but latter has better correlation with mode of delivery. This association may be explained by the fact that thinner scars have more chances of fetal bradycardia, meconium staining of liquor and previous cesarean for feto-pelvic disproportion.

Content: This study pertains to serial assessment of previous cesarean scar in antenatal period and whether it has a role in predicting successful VBAC.

Keywords Transvaginal sonography · Scar thickness · VBAC · Previous cesarean section · Second trimester

Riassunto

Scopo obiettivo dello studio è valutare se lo spessore della cicatrice, misurata con ecografia transvaginale e il cambio di spessore della cicatrice dal secondo al terzo trimestre, sono correlati con la modalità del parto, in pazienti con pregresso parto cesareo.

Metodi donne incinta, con pregresso parto cesareo, sono state sottoposte ad ecografia transvaginale tra la 24 a la 28 settimana di gestazione, poi ad un ulteriore esame oltre la 36 settimana di gestazione, per misurare lo spessore della cicatrice. Le misurazioni degli spessori della cicatrice sono state correlate con la modalità del parto. La cicatrice è stata

N. Singh (✉) · R. Tripathi · Y. M. Mala
Department of Obstetrics and Gynaecology, Maulana Azad
Medical College and Associated LokNayak Hospital, Bahadur
Shah Zafar Marg, Delhi Gate, New Delhi, India 110002
e-mail: nilanchalisingh@gmail.com

R. Tripathi
e-mail: revatripathi@gmail.com

Y. M. Mala
e-mail: ym_mala@yahoo.com

R. Dixit
Department of Radiodiagnosis, Maulana Azad Medical College,
New Delhi, India
e-mail: drrashmidixit@gmail.com

misurata in più punti (3-4) della parte inferiore dell'utero e la sua parte più sottile è stata considerata come la cicatrice. **Risultati** lo spessore della cicatrice era più sottile nelle pazienti che avrebbero avuto un parto cesareo rispetto a quelle con parto vaginale e questa differenza era statisticamente significativa, in entrambe le età gestazionali. Lo spessore medio della cicatrice a 24 a 28 settimane di gestazione in pazienti con parto per via vaginale era $4,8 + 1,1$ millimetri e in quelle con taglio cesareo $4,4 + 1,1$ millimetri (valore $p = 0,043$). Lo spessore medio della cicatrice oltre la 36 settimane di gestazione in pazienti con parto per via vaginale era $3,3 + 0,7$ millimetri e in quelle con taglio cesareo $2,9 + 0,9$ millimetri (valore $p = 0,003$). La diminuzione di spessore media della cicatrice non era significativamente differente tra quelle con parto vaginale (decremento medio = $1,73 + 0,95$ millimetri) e quelle con parto cesareo (riduzione media = $1,91 + 0,96$ millimetri). **Conclusioni** Il nostro studio ha evidenziato che cicatrici più spesse, dopo un parto cesareo, sono associate a maggiori probabilità di parto vaginale. Può essere fatta una misurazione sia a fine del secondo trimestre che del terzo trimestre, ma quest'ultima ha maggiore correlazione con la modalità del parto. Questa associazione può essere spiegata con il fatto che le cicatrici più sottili sono più spesso associate a bradicardia fetale, ileo da meconio e precedente cesareo per sproporzione fetopelvica.

Introduction

Cesarean section is the most commonly performed surgery in obstetrics. Repeat cesarean section accounts for one-third of all cesarean deliveries. Therefore, reduction in the rate of repeat cesarean section will lead to decrease in cesarean section rate. Hence, the importance of more patients being allowed to attempt vaginal birth after cesarean (VBAC) is explained. There is no consensus regarding decision of mode of delivery in patients with previous cesarean section. In recent years, there has been increasing concern about the increase in morbidity associated with trial of labor after previous cesarean, particularly the risk of uterine rupture [1]. Despite the known factors which affect the outcome of VBAC like interval between previous cesarean and current pregnancy, indication of previous cesarean, previous successful vaginal deliveries, postoperative wound sepsis, etc., there are no standard guidelines for patients of previous cesarean section to attempt VBAC [2]. There is insufficient evidence to recommend the mode of delivery in pregnancies with previous cesarean and this subject continues to be a matter of debate at present. Radiological evaluation of scar is not usually incorporated in decision making for mode of

delivery. Moreover, criteria for radiological evaluation like when and how to measure scar thickness are not standardized. The association between scar thickness and mode of delivery may be explained by the fact that thinner scars have more chances of fetal bradycardia, meconium staining of liquor and previous cesarean for fetopelvic disproportion. The present study was designed to study the relevance of serial measurement of scar thickness by transvaginal ultrasound and its association with mode of delivery in pregnancies with previous cesarean section.

Methods

This was a prospective longitudinal study conducted over a period of 2 years from August 2007 to March 2009. Ethical clearance was taken from the ethical society of the institution where study was conducted. Prevalence of VBAC is 40 % in previous cesarean section patients. The study included 168 patients with previous one lower segment cesarean section attending antenatal clinic of tertiary care hospital. Patients were recruited between 24 and 28 weeks period of gestation. Patients with grossly contracted pelvis, placenta previa, previous vesico-vaginal fistula repair or other indications of elective cesarean section were excluded. An informed consent was taken from all the patients prior to inclusion in the study. The transvaginal ultrasonographic evaluation of the lower uterine segment was performed between 24 and 28 weeks of gestation. The thickness of lower uterine segment was measured with the urinary bladder being partially distended by one of the authors. Ultrasonography was performed using 5–9 MHz transvaginal transducer of HD 11 Philips USG machine with a maximal axial resolution of 0.17 mm with a spatial pulse length of 2. A comprehensive scan of the lower uterine segment (LUS) in various planes was performed with the patient having a partially full bladder, so as to delineate the scar area clearly. LUS was also assessed for any evidence of asymptomatic uterine dehiscence. The normal lower uterine segment was seen juxtaposed to the bladder. The layers seen from the fetal to the maternal side were fetal skull and scalp, dark amniotic fluid band, hyperechoic decidua and membranes, intermediate myometrium, bladder wall and fluid-filled bladder (Fig. 1). The scar measurement was taken by placing calipers between decidua–myometrium junction and bladder–myometrium junction. The scar could be identified in only five patients with alteration in echogenicity of myometrium. In case of non-visualization of scar, measurements were taken at multiple sites (3–5) of the lower uterine segment and its thinnest portion was considered to be the scar. The area was evaluated in both transverse and sagittal planes but measurement was performed in sagittal plane in all patients

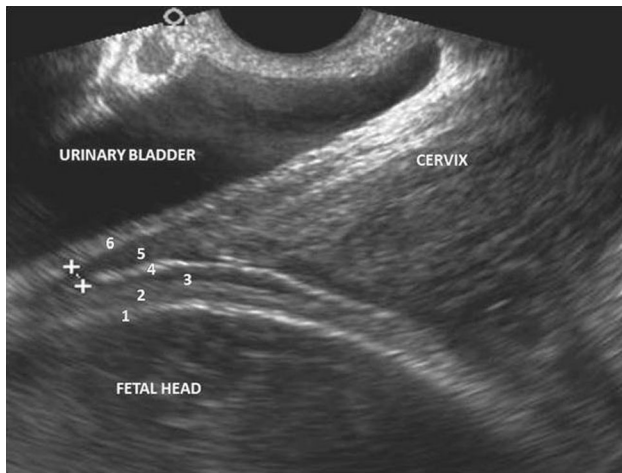


Fig. 1 Shows normal lower uterine segment juxtaposed to the bladder. The layers seen from the fetal to the maternal side are 1 fetal skull and 2 scalp, 3 dark amniotic fluid band, 4 hyperechoic decidua and membranes, 5 intermediate myometrium and 6 bladder wall

to eliminate bias related to direction of ultrasonic waves. In magnified images, the orientation of anatomy becomes difficult; hence, non-magnified images were utilized for measurement in most of the cases. The normal lower uterine segment was seen juxtaposed to the bladder. Measurements were taken at multiple sites (3–4) of the lower uterine segment and its thinnest portion was considered to be the scar. A comprehensive scan of the lower uterine segment in various planes was done to look for any asymptomatic uterine dehiscence.

The patients were then followed up routinely and the scar thickness was measured again after 36 weeks’ gestation, as described. At term gestation vaginal examination was performed by the consultant or senior resident for pelvic assessment to decide the mode of delivery. The obstetrician deciding the mode of delivery or conducting the delivery was blinded to the results of scar thickness of the concerned patient, that is, the radiological findings were not utilized

for decision making of mode of delivery. This was done to allow these women to undergo VBAC based on clinical parameters as is done in routine else, women with thin scars could have been planned for elective cesarean or cesarean at slightest indication. These scar thickness measurements and their change with advancing gestational age were then correlated with the mode of delivery. Statistical analysis was done using Stata-graphic software.

Results

Out of 168 patients recruited initially, 26 patients either lost to follow-up or delivered preterm. 142 patients had scar thickness measured by TVS at both the gestational ages and their data were used in final analysis. The population characteristics of the study population are depicted in Table 1. Patient’s age and gestational age were not significantly different between those who had vaginal delivery and repeat cesarean section. Patients who delivered vaginally had interval more than 19 months between previous cesarean and current pregnancy and this difference was statistically significant. Patients with previous VBAC had more chances of vaginal delivery. Birth weight was also significantly higher in those who had repeat cesarean section which could have been a confounding factor.

The scar thickness obtained at late second and third trimester by transvaginal sonography (TVS) is shown in Table 2. The mean scar thickness when measured sonographically between 24 and 28 weeks was 4.53 + 1.21 mm and beyond 36 weeks was 3.02 + 0.92 mm. The scar thickness was maximum in the range of 4–5 mm (31 %) in late second trimester and 2–3 mm (41.5 %) in third trimester. The change in scar thickness as measured by TVS from 24 to 28 weeks to beyond 36 weeks’ gestation is depicted in Table 3. The scar thickness decreased in maximum number of cases, i.e., in 92.3 % cases. It increased in 5.6 % cases and was unchanged in 2.1 %

Table 1 Population characteristics

Characteristics	Vaginal delivery (n = 96)	Cesarean delivery (n = 46)	p value
Mean age(years) + SD	26.79 + 2.56	26.24 + 2.24	0.17
Interval between previous cesarean and current pregnancy (in months)			
<18 months	5	14	0.011
>19 months	91	32	<0.001
No. of previous VBAC			
0	77	42	<0.001
1	18	3	
2	2	0	
Gestational age (in weeks)	38.03 + 1.25	38.44 + 1.22	0.057
Birth weight (in g)	2704.13 + 322.10	2869.17 + 243.18	0.049

Table 2 Distribution of TVS measured scar thickness at both the gestational ages

Scar thickness (in mm)	At 24–28 weeks' gestation N = 142 (%)	At 36 weeks and beyond N = 142 (%)
1–2	0 (0)	7 (4.9)
2.1–3	9 (6.3)	59 (41.5)
3.1–4	39 (27.5)	50 (35.2)
4.1–5	44 (31)	22 (15.5)
5.1–6	31 (21.8)	4 (2.8)
>6	18 (12.7)	0 (0)
Mean + SD	4.53 + 1.21	3.20 + 0.92

Table 3 Change in sonographically measured scar thickness with advancing gestational age and its correlation with mode of delivery

Change in scar thickness	Vaginal delivery (n = 96)		Cesarean delivery (n = 46)	
	Number	%	Number	%
Decrease in scar thickness	89	—	42	—
0.1–1 mm	22	22.9	10	21.7
1–2 mm	31	32.2	14	30.7
2–3 mm	30	30.1	13	28.5
3–4 mm	5	5.2	5	10.9
4–5 mm	1	1.1	1	2.2
Mean decrease	1.73 + 0.95		1.91 + 0.96 (p value = 0.31)	
Increase in scar thickness	5	5.2	3	6.5
2–3 mm	1	1.1	—	—
1–2 mm	—	—	1	2.2
0.1–1 mm	4	4.2	2	4.3
Mean increase	0.06 + 0.07		0.83 + 0.58 (p value = 0.58)	
No change	2	2.1	1	2.2
Total	96	100	46	100

cases. The mean decrease in scar thickness was 1.70 + 0.96 mm.

The success rate of VBAC in this study was 67.6 %. The indications of repeat emergency cesarean section were fetal distress (47.9 %), meconium stained liquor (24 %), cephalo-pelvic disproportion (10.7 %), scar tenderness (8.9 %),

failed induction (6.5 %) and scar dehiscence (2.2 %). The rate of scar rupture in this study was 0.7 % (one patient) and that of asymptomatic uterine dehiscence diagnosed per-operatively was 1.4 % (two patients). Scar thickness at 24–28 weeks in case of scar rupture and scar dehiscence was 2.6, 2.3 and 2.9 mm, respectively (less than 3 mm in all cases).

Scar thickness beyond 36 weeks in case of scar rupture and scar dehiscence was 1.2, 1.6 and 1.9 mm, respectively (less than 2 mm in all cases). Scar thickness was lesser in those patients having cesarean delivery than those who had vaginal delivery as shown in Table 4 and this difference was statistically significant at both the gestational ages but more so at third trimester. There was no statistically significant difference of change in scar thickness when measured at late second and third trimester among those who delivered vaginally and those who delivered by cesarean section. The change in scar thickness when measured at both gestational ages did not correlate with eventual mode of delivery as shown in Table 3.

Discussion

The rate of successful VBAC was 67.6 % in our study. Most of the earlier studies report the success rate of VBAC to be ranging between 60 and 80 % [3–6]. The rate of scar rupture in this study was 0.7 % and that of asymptomatic uterine dehiscence diagnosed per-operatively was 1.4 %. The risk of uterine rupture as reported in various studies ranges from 0.3 to 4 % [7–9]. In some prior studies [10–13] the scar thickness was measured trans-abdominally and in some studies it was measured by transvaginal route [14, 15]. Higher frequency transducers can be used while using transvaginal sonography as it is a near-field modality leading to better delineation of structures. Therefore, in this study transvaginal sonography was used to measure the scar thickness. Most of the previous studies [10, 12, 13] evaluated the importance of sonographical scar thickness measurement at term whereas only few studies [15] stressed on its importance in late second trimester. We measured scar thickness twice so that we may study whether change in scar thickness has any correlation with mode of delivery.

Table 4 Correlation of radiological findings with mode of delivery

	Vaginal deliveries		Operative deliveries		't' value, 'p' value
	No.	Mean + SD (mm)	No.	Mean + SD (mm)	
Scar thickness between 24–28 weeks	96	4.8 + 1.1	46	4.4 + 1.1	2.03 p = 0.043, (sig)
Scar thickness at >36 weeks	96	3.3 + 0.7	46	2.9 + 0.9	2.99 p = 0.003, (sig)

In our study, the scar thickness at 24–28 weeks was lesser in patients who had cesarean delivery than those who delivered vaginally, which was significant (p value = 0.043). There are not many studies on scar thickness measurement in second trimester. Gotoh et al. [15] reported that the mean scar thickness measured by TVS at 19 weeks' gestation in those delivering vaginally and by cesarean was 6.7 ± 2.4 and 6.8 ± 2.3 mm, respectively, which was not statistically significant. Unlike their study, our study concluded that in patients who are more prone to repeat cesarean section, the scars are thinner from early gestation only.

The patients had a second evaluation of scar thickness by TVS at 36 weeks of gestation. The scar thickness when measured beyond 36 weeks of gestation was 3.3 ± 0.7 and 2.9 ± 0.9 mm in those who delivered vaginally and by cesarean section, respectively (p value = 0.003). In this study, bladder wall was not included while measuring the scar thickness. Gotoh et al. [15] reported the scar thickness measured by transvaginal sonography at 39 weeks as 3.0 ± 0.7 mm in vaginal delivery group and 2.1 ± 0.7 mm in those delivered per-operatively. They also reported it to be significantly thinner in those having repeat cesarean. The scar thickness at more than 36 weeks was maximum in the range of 2–3 mm, i.e., in 41.5 % cases of the population in our study. Mazurek-Kantor et al. [13] reported that the scar thickness was maximum in the range of 3–4 mm, i.e., in 44.6 % cases. But in their study, the thickness of the bladder wall and the decidual membranes was also included which may be the reason of the higher range of scar thickness.

Rozenberg et al. [10] reported that the lower uterine segment was significantly thicker among women with a trial of labor (4.5 ± 1.4 mm) than those with an elective cesarean section (3.8 ± 1.5 mm). This study concluded that transabdominal USG measurement of the lower uterine segment could be used to increase the safe use of trial of labor. In another study by Rozenberg et al. [12], it was seen that the risk of uterine dehiscence was directly related to the thinning of lower uterine segment measured sonographically at 37 weeks of gestation. It was advocated in this study that trial of labor can be allowed if the scar thickness at 37 weeks is more than 3.5 mm. According to our study, thinner scars measured sonographically either between 24 and 28 weeks or beyond 36 weeks were associated with repeat cesarean section. We also found that scar thickness less than 3 mm in late second trimester and 2 mm in third trimester is associated with scar dehiscence or rupture though due to limitation of sample size, no statistical study could be done to prove this though.

As the scar thickness was measured twice in this study by TVS, the progressive alteration could be documented. The mean decrease in scar thickness when measured sonographically was 1.70 ± 0.96 mm. The decrease was in

the range of 1.1–2 mm in maximum number of patients, i.e., 44 patients (31.7 %). In this study, scar thickness decreased from 4.8 ± 1.1 to 3.3 ± 0.7 mm in those who delivered vaginally whereas it decreased from 4.4 ± 1.1 to 2.9 ± 0.9 mm in those who delivered by cesarean section. Thus, in this study though the scar was thinner in those who delivered by cesarean section but the mean decrease in scar thickness was not significantly different between those who delivered vaginally (mean decrease = 1.73 ± 0.95) and those who had a repeat cesarean (mean decrease = 1.91 ± 0.96). Gotoh et al. [15] reported that the thickness of lower uterine segment decreased from 6.7 ± 2.4 mm at 19 weeks POG to 3.0 ± 0.7 mm at 39 weeks of gestation in those who delivered vaginally. The thickness at both periods of gestation was more than 2 mm in all the cases. The lower uterine segment thickness in those who delivered by cesarean section decreased from 6.8 ± 2.3 at 19 weeks to 2.1 ± 0.7 mm at 39 weeks of gestation. Therefore in their study, there was significant difference in decrease in scar thickness when measured serially between those who delivered vaginally and those who delivered by cesarean section. Their study, however, did not quantify the decrease in scar thickness. In our study, we tried to quantify the change and study their significant impact on mode of delivery but we could not prove any such significance.

Factors which affect the mode of delivery, i.e., previous VBAC, short interdelivery interval, indication of previous cesarean, etc., are the expected confounders and lack of controlling them is the limitation of this study. Also, the USG machine available in the department had a 5–9 MHz transvaginal transducer with maximal axial resolution of 0.17 mm with a spatial pulse length of 2, leading to an intrinsic error of 3–5 % for each measurement between 3 and 5 mm. Another limitation is the small sample size, due to which no statistical evaluation could be done to determine minimum limit of scar thickness for predicting scar dehiscence.

Conclusion

Our study concluded that women with thicker scars are more likely to have successful VBAC. Our study also concluded that transvaginal sonography can be used to measure scar thickness in pregnant patients with previous cesarean section due to better delineation of structures such as bladder wall and decidual membranes. Scar thickness measurement at both late second trimester and third trimester can be utilized but scar thickness measurement in third trimester is more reliable. Larger studies are indicated to study whether scar thickness measurement can be incorporated in deciding mode of delivery in these women.

Conflict of interest Nilanchali Singh, Reva Tripathi, YM Mala, Rashmi Dixit declare they have no conflict of interest.

Informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). All patients provided written informed consent to enrolment in the study and to the inclusion in this article of information that could potentially lead to their identification.

Human and animal studies The study was conducted in accordance with all institutional and national guidelines for the care of human subjects.

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