Original Research Article

Comparative study of magnetic resonance morphometry and ultrasonography for assessment of post-cesarean uterine scar for trial of labor after cesarean delivery at a tertiary hospital

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Abstract

Background: TOLAC has an estimated higher risk of uterine rupture. In order to assess the risk of uterine rupture better, sonographic measurement of lower uterine segment thickness near term has been proposed by magnetic resonance imaging (MRI) and ultrasonography (USG) which is the current gold standard for this purpose. The aim of the present study was to compare magnetic resonance morphometry and ultrasonography for assessment of post-cesarean uterine scar for trial of labor after cesarean delivery at a tertiary hospital. **Material and Methods:** Present study was a prospective observational study carried out among 30 pregnant women with >37 weeks gestational age, history of previous one lower segment cesarean section for nonrecurrent obstetric indication, willing for TOLAC. Patients underwent ultrasonography and MRI, evaluated by senior radiologist blind to present study. Patients were followed till delivery. Mode of delivery and details were noted. **Results:** In present study, 30 term pregnant women, assigned for TOLAC underwent USG and MRI examination for assessment of scar thickness. Mean maternal age and gestational age was 26.3 ± 3.2 years and 37.2 ± 4 weeks respectively. Most patients had scar thickness 3.6 to 5 mm, followed by 2-3.5 mm. Difference between scar thickness on USG and MRI was not significant (p= 0.65) Patients with scar thickness less than 2 mm, no spontaneous labour onset till 40 weeks were posted for elective LSCS (23%). 53% delivered vaginally and 10% by instrumental delivery. 4 patients (13%) required emergency LSCS (2 for fetal distress, **Conclusion:** MRI is a safe, noninvasive and complementary imaging modality during pregnancy but ultrasonography remains investigation of choice for assessment of post-cesarean uterine scar for trial of labor after cesarean delivery.

Key Words: Scar thickness, trial of labor after caesarean (TOLAC), magnetic resonance imaging (MRI).

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INTRODUCTION

Cesarean section (CS) is one of most common major surgical procedures, life-saving both for the mother and the newborn when medically indicated.[1] Cesarean section rate has increased 2.9% of child birth in 1992-93 to 7.1% in 1998-99 and further rise to 8.5% in 2005-06 and a steady rise to 17.2% in 2015-16 and an average annual rate of increase of 8% is noted in India.[2] Trial of labor after cesarean delivery (TOLAC) refers to a planned attempt to deliver vaginally by a woman who has had a previous

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cesarean delivery, regardless of the outcome. For women with more than one previous cesarean delivery, TOLAC is likely to be successful, but with an estimated higher risk of uterine rupture (0.2 to 1.5% with a transverse uterine incision, 1.0 to 1.6% with a low-vertical uterine incision).[3] According to WHO, statement on caesarean section rates "Every effort should be made to provide caesarean sections to women in need, rather than striving to achieve a specific rate".[4] In order to assess the risk of uterine rupture better, sonographic measurement of lower uterine segment thickness near term has been proposed, assuming that there is an inverse correlation between LUS thickness and the risk of uterine scar defect. Magnetic resonance imaging (MRI) has recently shown promise for evaluation of uterine scar thickness. As opposed to ultrasonography (USG), which is the current gold standard for this purpose, MRI reduces observer dependence and has a superior multiplanar capability. These features may offer advantage while measuring uterine scar as well. The aim of the present study was to compare magnetic resonance morphometry and ultrasonography for assessment of post-cesarean uterine scar for trial of labor after cesarean delivery at a tertiary hospital.

MATERIAL AND METHODS

Present study was a prospective observational study carried out among 30 pregnant women with history of previous one lower segment cesarean section willing for trial of labor after cesarean delivery (TOLAC). Study was conducted in department of radiodiagnosis, during May 2020 to September 2020. Study was approved by institutional scientific research and ethics committee.

Inclusion criteria

- Pregnant women with >37 weeks gestational age
- History of previous one lower segment cesarean section for nonrecurrent obstetric indication
- Screened by obstetrician for trial of labor after cesarean delivery (TOLAC) and noted that TOLAC can be attempted
- Patient is willing for trial of labor after cesarean delivery (TOLAC).

Exclusion criteria

- Patients with multiple pregnancies, preterm deliveries, polyhydramnios or oligohydramnios, low lying placenta,
- Patients with history of uterine surgery other than cesarean section or unavailable previous caesarian details,
- Patient having a contraindication to MRI were excluded from the study.

Written informed consent was obtained from all the participants prior to enrolment, and the regulations of PCPNDT act were followed during all scans. Patients underwent ultrasonography and MRI, evaluated by senior radiologist blind to present study. Demographic details, clinical history, clinical examination was done and findings were noted in proforma. All sonographic examinations were done after confirmed 37 weeks of gestational age to assess the lower uterine segment (LUS), on a high-end equipment (iU22; Philips Medical System, Andover, MA, USA) using a 3.5-MHz multifrequency convex transabdominal transducer. Transabdominal ultrasonography was done and LUS was scanned in sagittal section under magnification to localize the thinnest zone. Measurements were taken with the '+' shape cursors at urinary bladder wall – myometrium interface and myometrium/chorioamniotic membrane – amniotic fluid interface. Average of 3 readings taken was recorded. MRI was done on a 1.5-Tesla (Siemens Avanto, Erlangen, Germany) system with an actively shielded whole body superconducting magnet. Imaging was done using an 8-channel Torso phased-array body coil with the patient in the supine position and a moderately full urinary bladder. The focus of imaging was tapered down to pelvis with the field of view just enough to cover the area (40 cm). Predesignated standard protocols were followed consisting of T1W and T2W imaging sequences in axial and sagittal planes remaining perpendicular to the long axis of the scar. Initial single shot localizers were taken to define the uterine scar (similar to the method followed by sonography), followed by oblique images which were exactly perpendicular to the scar. The measurements were taken in T2 mid-sagittal image at the thinnest portion of the scar. Findings were noted in proforma. Patients were followed till delivery. Mode of delivery and details were noted. Descriptive statistics in form of percentages and mean was used. USG and MRI findings of scar thickness were compared with students t test. p value less than 0.05 was considered significant.

RESULTS

In present study, 30 term pregnant women, assigned for TOLAC underwent USG and MRI examination for assessment of scar thickness. Mean maternal age and gestational age was 26.3 ± 3.2 years and 37.2 ± 4 weeks respectively.

Table 1: General characteristic

	Mean ± SD
Maternal age (in years)	26.3 ± 3.2
Gestational age (in weeks)	37.2 ± 4

Most patients had scar thickness 3.6 to 5 mm, followed by 2-3.5 mm. Difference between scar thickness on USG and MRI was not significant (p= 0.65)

Table 2: Distribution of scar thickness and assessment by USG and MRI

Scar thickness (mm)	USG (%)		MRI (%)	
Less than 2	3	10%	4	13%
2-3.5	7	23%	7	23%
3.6-5	11	37%	13	43%
More than 5	9	30%	6	20%

Patients with scar thickness less than 2 mm, no spontaneous labour onset till 40 weeks were posted for elective LSCS (23%). 53% delivered vaginally and 10% by instrumental delivery. 4 patients (13%) required emergency LSCS (2 for fetal distress, 1 for nonprogress of labour and 1 for deep transverse arrest). Dehiscemce was noted in 2 patients (indication fetal distress, scar thickness 2-3.5 mm). No uterine rupture, neonatal/maternal morbidity/mortality noted.

Table 3: Mode of delivery in TOLAC patients

Characteristic	Number of cases	%
Mode of delivery		
Elective LSCS	7	23%
Emergency LSCS	4	13%
Vaginal (Spontaneous/ Assisted)	16	53%
Instrumental	3	10%
Indication of repeat emergency caesarean		
Fetal distress	2	7%
Nonprogress of labour	1	3%
Deep transverse arrest	1	3%
Dehiscence of the scar		
Elective LSCS	0	
Emergency LSCS	2	7%

DISCUSSION

A dramatic decrease in TOLAC may be associated with fear of potential complications, most serious being uterine rupture. The risk of uterine rupture is 0.52% for women who go into spontaneous labor, 0.77% for women with labor induced without prostaglandin and 2.45% for labor induced with prostaglandin.[6] Several factors increase the likelihood of a failed trial of labor, which in turn is associated with increased maternal and perinatal morbidity when compared with a successful trial of labor (i.e., VBAC) and elective repeat cesarean delivery.[7] Factors affecting risk for TOLAC are 1- or 2-layer uterine closure, inter-delivery interval, number of previous cesarean sections and previous vaginal delivery, are debated in the literature, but definitive guidance for clinical decision-making is not provided.[8] Uterine scar dehiscence is defined as a loss of continuity of the myometrial layer without the complete rupture of the LUS, also called uterine 'window'. Uterine rupture is defined as a complete separation of the uterine scar resulting in a communication between the uterine and peritoneal cavities. Scar dehiscence in patients of previous caesarean section is a serious complication because if not predicted it can lead to uterine rupture with serious maternal and perinatal morbidity and mortality. But it is very difficult to predict scar dehiscence with either individual or a combination of clinical factors.[9] Trails have been made to visualize the lower uterine segment (LUS) and previous C.S scar. Many methods have been suggested, including Hysterography, sonohysterography, hysteroscopy, magnetic resonance imaging and ultrasonography. [10] LUS thickness is measured including parts of the urinary bladder wall (full LUS thickness) in some studies and only the mere myometrial layer (myometrial LUS thickness) in other studies.[11,12] The optimal cut-off value predicting scar dehiscence varied from 2.0 to 3.5 mm for full LUS thickness and from 1.4 to 2.0 for myometrial layer.[10] Sonographic lower uterine segment measurement is dependent on the skill of the operator, making it challenging to standardize techniques. A lower uterine segment thickness >3.65 mm is likely safe for TOLAC and a thickness of 2-3.65 mm is probably safe when the clinical criteria for TOLAC are met. A lower uterine segment thickness of <2 mm likely identifies women at a higher risk of uterine rupture.[13] Similar findings were noted in present study. Satpathy G *et al...*,[14] conducted a prospective case-control observational study in patients considered for TOLAC but eventually proceeding to lower segment cesarean section (LSCS). The diagnostic accuracy of USG for differentiating a normal from an abnormal uterine scar was 96.7% while that of MRI was at a slightly lower level of 90%. A strong level of agreement between the two modalities was observed. Similar findings were noted in present study. The authors concluded that MRI offers advantage in diagnostic accuracy for the measurement of LSCS scar thickness during consideration of TOLAC and MRI can be a useful adjunct tool to evaluate lower segment caesarean scar. Similarly, Hoffmann J *et al...*,[15] retrospectively analyzed 3 T MRI scans of 164 pregnant women, 60 patients with previous CS and 104 patients without previous CS. The authors concluded that variability in anatomy, thickness and morphology seem to limit common prenatal LUS imaging diagnostics. An additional MRI might be useful for altered anatomy and impaired ultrasound conditions. Tailored application of MRI with utilization of specific imaging protocol has been shown to have better contrast resolution than other modalities and can offer optimal contrast resolution for the above described purpose also. Further, with multiparametric capabilities defining a scar may be best done by MRI.[16] The peculiarity of the lower uterine segment, given the thin muscle layer and poor vascularization make it elective place to make incision, and "locus minoris" resistance to rupture of the uterus. Myometrium inadequate for vaginal delivery are balloon like shape of the lower uterine segment, thickness less than 3 mm, the discontinuity of uterine structures,

predominance of areas of increased echogenicity in the scar area.[17] However scar integrity during labour not only depends on its prelabour thickness but also on elasticity of scar tissue and its capacity to undergo stress. Ultimately, the decision for TOLAC is a discussion between the woman and her healthcare provider, but lower uterine segment thickness should be used as an additional tool to assist in making an informed decision.

CONCLUSION

MRI is a safe, noninvasive and complementary imaging modality during pregnancy but ultrasonography remains investigation of choice for assessment of post-cesarean uterine scar for trial of labor after cesarean delivery. Due to different technique and the associated advantages, MRI can be additional noninvasive image modality for prenatal LUS diagnostics and assessment of scar thickness in patients with previous caesarean section for trial of labour after caesarean section.

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