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ORIGINAL ARTICLE

OPERATIVE AND ULTRA-SONOLOGICAL ASSESSMENT OF LOWER UTERINE SEGMENT THICKNESS IN PREDICTING SCAR DEHISCENCE

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ABSTRACT

Background: As caesarean section rates are increasing so a valid, non-invasive and reliable method to assess integrity of caesarean scar is required to select patients for safe trial of labour. The objective of this study was to determine accuracy of ultrasound-based lower uterine segment thickness assessment in predicting risk of scar dehiscence in women with previous one lower uterine caesarean scar.

Materials & Methods: The study design was descriptive longitudinal conducted in Gynae and Obstetrics Department, PIMS Hospital, Islamabad for the duration of 6 months. Sample size was 93 and sampling technique was consecutive non probability**.** Our sociodemographic variables were age and parity. Our research variables were thickness of lower uterine segment on ultrasonography and scar thickness intraoperatively. Data was stratified for age and parity and validity of ultrasound findings was evaluated taking intra-operative scar assessment as gold standard. All variables were described descriptively as frequency and percentages for each stratum. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of USG assessment was calculated.

Results: The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasonographic findings was 89.36%, 91.3%, 91.3%, 89.36%, 90.32% respectively taking intra-operative scar assessment as gold standard**.**

Conclusion: The measurement of lower uterine segment thickness by transabdominal ultrasound agrees strongly with intra-operative assessment having high diagnostic accuracy.

KEY WORDS: Ultrasonography; caesarean section; age; parity.

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INTRODUCTION

The old principle, once a caesarean always a caesarean is obsolete now because now obstetrician know that it is safe to give trial of labour to women with previous caesarean scar. Moreover, it is established through research that vaginal birth is safer than caesarean delivery in terms of maternal morbidity and mortality.[1,2] But at the same time obstetricians are unable to confirm accurately whether scar in lower uterine segment is intact and strong enough to be given a trial of labour. This non reassurance may lead to repeat caesarean section. As trend of caesarean deliveries is going high, it has become a matter of concern for obstetricians as well as common man. Medical professionals strongly suggest trial of labour in women with previous one C-section scar in lower uterine segment unless there is some absolute contraindication to trial of labour as frequency of repeat C-section is already high 55 to 60%.[3]

Vaginal delivery has many pros like less maternal morbidity and mortality as well as decreased length of hospital stay, lessening financial burden on state and patient. While giving trial of labour to pregnant women with previous C-section scar, serious complication of uterine scar rupture cannot be ignored

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leading to high maternal and foetal mortality.[4]

According to RCOG guidelines, October 2015, planned vaginal birth after C-section (VBAC) may be offered to most of pregnant women with a single foetus of cephalic presentation at term with single previous lower segment caesarean delivery, with or without a history of previous vaginal birth except for women with absolute contraindication to vaginal birth e.g. placenta praevia major.[5-7]

A valid and reliable method to assess integrity and strength of scar is required before giving safe trial of labour for vaginal birth after C-section. One such method is ultrasonographic assessment of lower uterine segment LUS thickness as predictor of weakness or dehiscence of scar.[8] Advantages of this method are, safety, non-invasiveness, time efficient, no risk of radiation so can be repeated on same patient.[9]

The objective is to evaluate the accuracy of abdominal ultrasound-based LUS thickness in predicting scar dehiscence/ risk of scar dehiscence in women with previous one lower uterine caesarean scar taking intraoperative assessment of LUS as gold standard.

MATERIALS AND METHODS

The study design was descriptive longitudinal conducted in Gynae and Obstetrics Department, PIMS Hospital, Islamabad for the duration of 6 months. To calculate sample size, the following factors were entered into the WHO sample size calculator: Sensitivity 77.8%, Specificity 88.6%, Expected prevalence 50%, Precision level 10%, Confidence level 95% and Sample size was 93. Ethical approval was granted by institutional research ethical review committee. Sampling technique was non-probability, consecutive.

The inclusion criteria were term pregnant females with ages in the range of 25-40 years with previous 1 lower uterine segment caesarean scar who signed written informed consent to participate in the study and who were planned to undergo elective 2nd caesarean section due to any obstetrical reason other than mentioned in exclusion criteria. The exclusion criteria included multiple gestation, Placenta praevia, Polyhydramnios, Hydrocephalic foetus, labouring women with previous 1 scar.

After meeting inclusion criteria, 93 females were enrolled. A transabdominal ultrasonography (USG) of lower uterine segment (LUS) was performed with full urinary bladder antenatally closest to date of planned caesarean section by a consultant radiologist.

The lower uterine segment thickness was measured three times in longitudinal plane. Mean of these measurements was taken to determine the thickness of the lower uterine segment. Positive USG assessment is defined as lower uterine segment thickness of < 3.6mm which indicates scar dehiscence/ risk of dehiscence or weak scar.[10] Patients were monitored until birth through C-section. The doctor conducting the caesarean section took note of the condition of the lower uterine segment scar at the time of the procedure.

Patients were categorised into three categories according to Fukuda M.'s three criteria based on the findings.[11]

Grade I- No thinning of lower uterine segment

Grade II- Thinning and loss of continuity of lower uterine segment but foetal hair not visible

Grade III- Thinning of lower uterine segment and foetal hair visible or window defect i.e. foetal parts could be seen through lower uterine segment.

Positive intraoperative assessment meant grade 2 or grade 3 of Fakuda M criteria. Negative intraoperative assessment meant grade 1 Fakuda M criteria. For final analysis, the results of the per operative findings and ultrasonography both were taken into consideration.

All variables were categorical. Categorical variables described descriptively as frequency and percentages. Evaluation of validity of USG findings was done by taking intraoperative findings as gold standard and constructing 2x2 table showing true positive, false positive, true negative and false negative. SPSS version 21 was used for data analysis. Sensitivity, specificity, positive predictive value PPV, negative predictive value NPV and diagnostic accuracy of USG assessment was calculated.

RESULTS

The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasonographic findings was 89.36%, 91.3%, 91.3%, 89.36%, 90.32% respectively taking intra-operative LUS scar thickness assessment as gold standard. (Table 1)

In patients having age $\leq$30 years the sensitivity, specificity and diagnostic accuracy of ultrasonographic findings was 80.77%, 88.46% and 84.62% respectively taking intra-operative scar assessment as gold standard. Similarly, in patients having age $>$30 years the sensitivity, specificity and diagnostic accuracy of ultrasonographic findings was 100%, 95% and 97.56% respectively taking intra-operative scar assessment as gold standard. (Table 2)

The sensitivity, specificity, and diagnostic accuracy of ultrasonographic findings in para 1 patients were all high 77.78%, 100% and 90.48% respectively taking intra-operative scar assessment as gold standard. Similarly, in para $\geq$ 2 females; the sensitivity, specificity and diagnostic accuracy of ultrasonographic findings was 92.11%, 88.24% and 90.28% respectively taking intra-operative scar assessment as gold standard. (Table 3)

Table 1: Validity of ultrasound findings taking intra-operative scar assessment as gold standard

US Findings		Intraoperative Scar Assessment Scar weakness/ dehiscence		Total
		Positive	Negative	
Scar weakness/ dehiscence	Positive	42 (91.3%) TP	4 (8.7%) FP	46
	Negative	5 (10.6%) FN	42 (89.4%) TN	47
Total		47 (50.5%)	46 (49.5%)	93

Sensitivity 89.36%, Specificity 91.3%, PPV 91.3%, NPV 89.36% & Diagnostic Accuracy 90.32%

Table 2: Validity of ultrasound findings taking intra-operative scar assessment as gold standard stratified by age groups

Age Groups	US Findings Scar weakness/ dehiscence	Intraoperative scar Assessment Scar weakness/ dehiscence		Total
		Positive	Negative	
≤ 30	Positive	21 (87.5%)	3(12.5%)	24
	Negative	5(17.9%)	23(82.1%)	28
>30	Positive	21 (95.5%)	1(4.5%)	22
	Negative	0 (0.0%)	19 (100.0%)	19

US Findings	Age (Group)	
	≤30	>30
Sensitivity	80.77%	100%
Specificity	88.46%	95%
PPV	87.5%	95.45%
NPV	82.14%	100%
Diagnostic Accuracy	84.62%	97.56%

Table 3: Validity of ultrasound findings taking intra- operative scar assessment as gold standard stratified by parity

Parity	US Findings Scar weakness/ dehiscence	Intraoperative scar Assessment Scar weakness/ dehiscence		Total
		Positive	Negative	
Para 1	Positive	7 (100.0%)	0 (0.0%)	7
	Negative	2 (14.3%)	12 (85.7%)	14
Para ≥ 2	Positive	35 (89.7%)	4 (10.3%)	39
	Negative	3 (9.1%)	30 (90.9%)	33

US Findings	Parity	
	Primary	Multiple
Sensitivity	77.78%	92.11%
Specificity	100%	88.24%
PPV	100%	89.74%
NPV	85.71%	90.91%
Diagnostic Accuracy	90.48%	90.28%

DISCUSSION

Caesarean section rates are increasing with a fall in the rate of trial of labour after caesarean section. So, the predictive characteristics of ultrasonological assessment of lower uterine segment (LUS) thickness for uterine rupture during labour is easy and non-invasive method.[12]

The caesarean delivery rate is on the rise globally over the past 3 decades, reaching 31.9% in the United States. One of the common indications is a history of a previous one caesarean delivery and it accounts for more than one-third of caesarean deliveries yearly.[13]

Using intra-operative scar evaluation as the gold standard, our study demonstrated that the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of ultrasonographic assessment were respectively, 89.36 percent, 91.3 percent, 91.3 percent, 89.36 percent, and 90.32 percent.

Sharma C et al. concluded that Sonographic evaluation of LUS thickness is a safe and non-invasive method for predicting risk of scar dehiscence. Specific guidelines for trial of labour after caesarean section with ultrasonological assessment of women with previous caesarean section, are need of the hour.[9]

Another study by Swift BE et al. demonstrated that lower uterine segment thickness >3.65 mm, measured with sonographic assessment, is associated with lower chance of uterine scar dehiscence. Full LUS thickness measurement using cut-offs between 3.1 and 5.1 mm reached a specificity of 0.63 (95% CI, 0.30–0.87) at a sensitivity of 0.96 (95% CI, 0.89–0.98). Thus, it shows importance of ultrasonological assessment of lower uterine segment thickness in women with previous caesarean delivery for subsequent successful vaginal birth.[12]

Rozenberg P et al. reached the conclusion that uterine scar dehiscence rate in the study group was 0.4% and in the control group 0.9% (relative risk, 0.43; 95% confidence interval, 0.15–1.19). Sonographic measurements of lower uterine segment thickness did not result in a statistically significant lower frequency of maternal and perinatal adverse outcomes.[13]

In another study by Uharček P et al, 2.5 mm was considered the critical cut-off value of the LUS thickness by transabdominal scan. This critical cut-off value was derived from the ROC curve with sensitivity, specificity, PPV, and NPV of 90.9, 84, 71.4, and 95.5 %, respectively. The linear regression model analysis revealed that full LUS thickness of <2.5 mm was the only factor to be correlated with translucent lower uterine segment. (8.8 vs. 0 %; $P = 0.02$). Thus, concluded that full LUS thickness of <2.5 mm as measured by TAS, is associated with a higher risk of uterine dehiscence.[14]

A study by Jastrow N et al. showed significant predictive value of lower uterine segment measurement by ultrasonography for risk of scar dehiscence. So, measuring this while deciding route of delivery may be helpful for obstetricians. Lower uterine segment thickness was <2.0 mm in 194 women (11%), 2.0–2.4 mm in 217 women (12%), and ≥2.5 mm in 1438 women (78%). Rate of trial of labour was 9%, 42%, and 61% in the 3 categories, respectively ($P<.0001$).[15]

Ashmawy NI et al. compared the lower uterine segment thickness by TAS and intraoperative, it demonstrated no significant difference (P > 0.17) between the mean values by both methods 4.9±1.03 and 5±0.85 respectively. It showed that all cases found to be of thickness <3.5mm per-operatively were also found to have <3.5mm LUS thickness by transabdominal ultrasound. 74.1% were found to have thickness of 3.5-5mm intraoperatively which was same as measured by TAS. 93.6% of those with LUS thickness of >5mm intraoperatively, had the same thickness as was assessed by TAS. Thus, there was a significant agreement i.e. P<0.001. The study showed non-significant negative correlations between transabdominal ultra-sonographic LUS thickness and age, parity, gestational age and number of abortions.[16]

CONCLUSION

The measurement of lower uterine segment thickness by transabdominal ultrasound agrees strongly with intra-operative assessment having high diagnostic accuracy, thus helps in better evaluation of risk of intrapartum complication of uterine rupture.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	SB, HN, HF
Acquisition, Analysis or Interpretation of Data:	SB, HN, HF, AN, KW, MAR, MS
Manuscript Writing & Approval:	SB, HN, HF, AN, KW, MAR, MS

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.