

Ultrasonographic Monitoring of Scarred Lower Uterine Segment during Pregnancy

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Abstract: This paper discusses evaluation of Trans-Abdominal Ultra-Sound (TAUS) for the diagnosis of defects or abnormal thinning in the scarred lower uterine segment during 3rd trimester of pregnancy done as near to expected date of delivery (EDD) as possible so that selection of women for a trial of labor for vaginal birth after Caesarean Section (C-Section) (TOL-VBAC) can be done. The study population consisted of 103 women attending the antenatal clinic of this hospital. Of these, 22 were primigravidae (control group) and 81 were multi gravidae with 1 previous Lower Segment C-Section (LSCS) (test group). Each study included multiple measurements of the thickness of the anterior wall of Lower Uterine Segment (LUS) both in longitudinal and transverse sections. Minimum three readings were taken. An average of these was taken to be the thickness of LUS. Any asymmetry of the thickness of the LUS resulting in wedge defect was made. Patients were followed up to the time of delivery. Those delivered by LSCS were considered for the final analysis. During LSCS, the thickness of LUS was measured. The Ultrasound (U/s) and laparotomy findings were compared and the test parameters of TAUS were calculated. Positive and negative predictive value was 100%. An LUS with sonographic wall thickness < 3mm is abnormally thin. Study results suggest that TAUS is safe and reliable test with a high degree of specificity and sensitivity to diagnose defects, ballooning, and abnormally thin lower uterine segment. This will help obstetricians in deciding which patient may be allowed a TOL-VBAC.

Keywords – TAUS, LUS, Previous C-Sections, TOL-VBAC

I. Introduction

With increasing safety of anesthesia, availability of antibiotics, blood transfusion facilities and advances in perinatal care, indications for C-Section are being liberalized both for the benefit of mother and child. As a result there is increase in the number of primary as well as repeat C-Sections.

At Government General Hospital, Guntur, the rate of LSCS was 38% in 2013, 35% in 2014. Nearly 45% are primary and 55% are repeat sections. The average number of deliveries per year at this hospital is 8000-9000. Hence, a large number of women are added every year to the group who are potential candidates for a trial of labor for vaginal birth after C-Section (TOL-VBAC).

Repeat C-Section constitutes the commonest indication for Cesarean delivery in most countries. For a long time it was believed that women who had a cesarean delivery would need C-Section for all future pregnancies. The dictum “Once a Cesarean, always a cesarean” originally enunciated by Cragin (1916) is replaced by “Once a Cesarean, always a trial of labor”, Panerstein (1966). Later, it became “Once a Cesarean, always a controversy”, Flamm (1997). [1]

The “NIH” panel (2010) (National Institute of Health) recommended that a “Trial of labor” meaning a planned attempt to give birth vaginally was a reasonable option for many pregnant women who had one prior C-Section. Later “American College of Obstetrics and Gynecology” updated its guidelines, expanding NIH recommendations and suggesting vaginal delivery after C-Section was a safe and appropriate option for most women including those with 2 previous C-Sections.

The rising rate of C-Section has been the subject of much attention by medical, professional and lay communities. TOL-VBAC has been increasingly supported by the medical community because approximately 55-60% C-Sections are repeat procedures. The advantages of vaginal delivery include decreased maternal and neonatal morbidity and mortality, and also decreased hospital stay and cost.

Maternal mortality is 3-7 times higher with Cesarean than with vaginal delivery. VBAC rates increased from 3.4% in 1980 to a peak of 28.3% in 1986 in USA. Because of the risk of uterine rupture, TOL-VBAC rates declined to 10% in 2000 (USA). In Government General Hospital, Guntur, the incidence of VBAC varied from 10% to 20% in 2013-14. Attempted vaginal birth after previous C-Section remains controversial. Although it has been reported safe and has contributed to reduced C-Section rate, VBAC is associated with a risk of uterine rupture. As a result, the selection of patients who can undergo such a procedure has become an important prerequisite.

It is generally considered that among carefully selected patients, women with previous one C-Section are suitable candidates for VBAC and should be offered a trial of labor. Although the efficacy and safety of vaginal birth after C-Sections has been shown, there are no reliable methods available to measure the strength of uterine scar – an important factor that determines the success of TOL-VBAC. In the past, postpartum hysteroqram has been used to diagnose weak scar but is no longer popular because of its invasiveness. At present TAUS, TUS and MRI are used to detect abnormalities in the lower uterine segment.

TAUS was performed during last trimester of pregnancy to detect abnormalities in the LUS in the present study. The abnormal sonographic findings in the scarred LUS are abnormally thin LUS, wedge defect, ballooning of LUS, Scar dehiscence, and scar rupture.

II. Material and Methods

This prospective study was conducted in the Department of Obstetrics and Gynecology of Guntur Medical College, Guntur.

The study was done on 103 women attending the antenatal clinic of this hospital. Of these, 22 were primigravidae (control group) and 81 were multigravidae with 1 previous LSCS (test group). Women who were sure of their Last Menstrual Period (LMP) and singleton pregnancy with Cephalic presentation were taken into study. The women in both groups were selected by random sampling and followed up to the time of delivery. Women with multiple fetuses, placenta praevia, polyhydramnios, oligohydramnios and hydrocephalic foetus were excluded from the study.

Trans-abdominal Ultrasonography of the LUS was performed in the third trimester of pregnancy. All attempts were made to do the scan as close as possible to the expected date of delivery. 8 primigravidae and 12 women in the test group had TAUS at 32-34 weeks pregnancy and again at nearing Expected Date of Delivery. The two scan reports were compared. No scan was performed during labor.

A moderately disintended bladder was used to create a satisfactory sonographic window. The thickness of the anterior wall of the LUS was measured from the interface of the urine and posterior wall of the bladder to the interface of the amniotic fluid and deciduas (Fig.1). This is because it is impossible to differentiate the fetal membranes, deciduas, bladder mucosa and musculature from the myometrium of the LUS by ultrasonography.

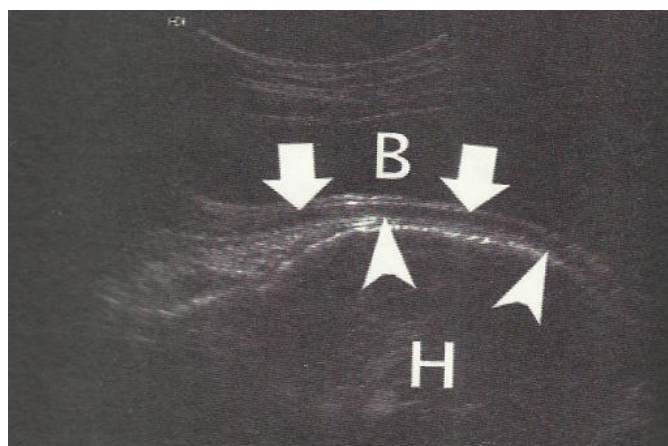


Fig. 1. Longitudinal Sonogram of LUS showing Urinary bladder wall Myometrial interface (Arrows) and the myometrium/ chorioamniotic membrane – amniotic fluid interface (Arrow heads);
B- Indicates Urinary bladder; H – Indicates Fetal head

Each study included multiple measurements of the thickness of the anterior wall of the LUS, both in the longitudinal and transverse section. An average of these was taken to be the thickness of the LUS; a minimum of three readings were taken. In the test group note was made of any asymmetry of the thickness of the LUS resulting in a wedge defect; in the presence of this phenomenon, the thickness of the LUS in the defective area was noted separately.

For analysis purposes, a wall measurement value more than 2 standard deviations (SD) below that in the control group was considered to be abnormally thin. The test patients were divided into ultrasound positive or negative groups in the presence or absence of abnormal sonographic findings respectively. Abnormal sonographic findings included an abnormally thin LUS, wedge defect and scar dehiscence and ballooning of LUS.

Patients were followed up to the time of delivery. Those delivered by LSCS were considered for the final analysis. The decision for a repeat LSCS or TOL-VBAC was not dependant on the sonographic findings and was entirely based upon the treating obstetrician's evaluation.

During LSCS, the thickness of the LUS was measured. The LUS was labeled as abnormal if it was abnormally thin, had a wedge defect, ballooning of the LUS, scar dehiscence or rupture. As above, a LUS thickness more than 2 SDS below that in the control group, a paper thin LUS that was easy to cut through, and a LUS through which foetal parts could be seen (window defect) were considered to be abnormally thin.

The ultrasonography and laparotomy findings were compared and the test parameters of TAUS calculated.

III. Results

Ten controls and 61 women from the test group who were delivered by LSCS were considered for the final analysis.

The sonographic thickness of the LUS in the control and test groups and their comparison is shown in Table 1. A thickness of <3 mm was considered to be abnormally thin. The LUS of control group was significantly thicker than the LUS of the test group among women delivered by LSCS. There was also significant difference in the LUS thickness between the two groups who delivered vaginally. (Table 1)

8 primis and 12 women in the test group have TAUS at 32-34 weeks of pregnancy and again at nearing EDD. There was significant difference between the thickness of LUS measured at first and second scans in either group (Table 2).

There were 5 Ultrasound positive cases in the test group. These all were delivered by LSCS. The thickness of LUS was significantly greater in the Ultrasound negative cases compared to Ultrasound positive cases (Table 3). The thickness of the LUS measured at LSCS was significantly greater in the control group compared with the test group (Table 4). P value < 0.01. In addition LUS thickness measured at LSCS was significantly greater than that measured during Ultrasound; both in the control and in the test group. This difference may be due to the absence of stretch factor since measurements taken at LSCS were after the delivery of the baby.

Table 1: Lower Uterine Segment Thickness on Ultrasonography

Route of delivery/ group	No. of patients	Mean (mm)	Standard Deviation (mm)	Standard Error (mm)	Intergroup Comparison (mm)
LSCS control	10	5.4	1.08	0.342	Z = 2.63 P > 0.004
Test	61	4.2	2.62	0.335	
Vaginal Delivery Control	12	5.2	0.68	0.196	Z = 2.31 P < 0.01
Test	20	4.5	1.04	0.233	

Table 2: LUS Thickness Measured on U/s during 32-34 weeks and Late III trimester (nearing EDD)

Group/ Period of Gestation	No. of patients	Mean (mm)	Difference between mean (mm)	Standard Error (mm)	Test statistics
Control: 32-34 weeks	8	7.6	2.6	0.12	T = 3.02
>38 weeks	8	5.1			
Test: 32-34 weeks	12	7.1	2.9	1.02	T = 2.92 P < 0.02
>38 weeks	12	4.2			

Table 3: LUS Thickness on U/s in the Test Group

Group	No. of patients	Mean (mm)	Standard Deviation (mm)	Standard Error (mm)	Intergroup Comparison (mm)
U/s +ve	5	3.1	1.197	0.535	Z = 2.64 P > 0.004
U/s -ve	56	4.8	2.703	0.361	

All 5 U/s positive cases were confirmed at laparotomy. The test parameters of TAUS for the diagnosis of defects and abnormal thinning of scarred LUS during pregnancy have a specificity of 1 and sensitivity of 1. The positive and negative predictive value was 100%.

Table 5 shows ultrasound positive cases. Out of the five ultrasound positive cases, two patients showed abnormally thin LUS, i.e. < 3 mm (Fig. 2) which was confirmed during surgery.

Table 4: LUS Thickness measured at LSCS

Group	No. of patients	Mean (mm)	Standard Deviation (mm)	Standard Error (mm)	Intergroup Comparison (mm)
Control	10	6.1	1.197	0.378	Z = 2.27
Test	61	5.2	0.93	0.119	P < 0.01

Table 5: LUS appearances during U/s and at LSCS in U/s +ve Cases

Type of Defect/ case	Ultrasound thickness (mm)	LSCS Size of Defect (in mm ²)	Wall Thickness (mm)	Details
Abnormally thin LUS				
Case No. 1	2.6		3	Uniformly thin
Case No. 2	0.7		1.2	Uniformly thin
Ballooning of LUS				
Case No. 3	2.3	2.8 X 3.5	3	Wedge palpated below the incision
Wedge Defect				
Case No. 4	3.4		4	H/o Post operative sepsis adhesions
Scar Dehiscence				
Case No. 5	-		-	Abnormal Ballooning

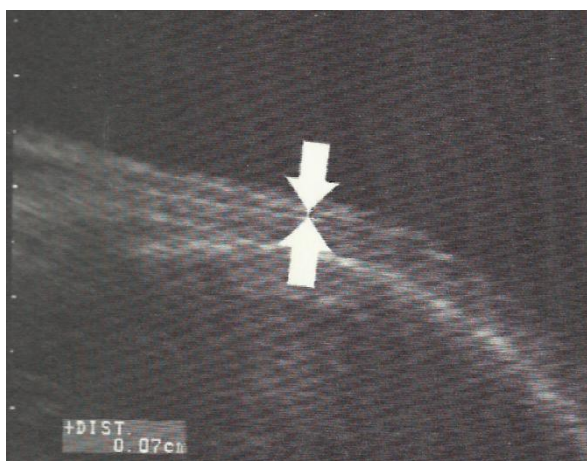


Fig. 2. Longitudinal Sonogram showing an extremely thin LUS (0.7 mm)

One patient with an abnormally thin LUS on sonography had a window defect measuring of 2.8 X 3.5 cm size (Fig. 3). At Cesarean section fetal scalp is visible through the defect. In another patient with ballooning of LUS there was history of puerperal sepsis. During surgery plenty of adhesions (Fig. 4) were noted and thinned out and ballooned LUS (Fig. 5) was noticed.

IV. Discussion

This study demonstrates the safety and relative reliability of using TAUS to identify defects and abnormal thinning of the LUS during the third trimester of pregnancy. The test parameters of TAUS in this trail are similar to those reported by other workers.

During the initial part of study we noted a large number of control cases to have a LUS thickness of 5 – 5.5 mm at TAUS. Based on this observation, we calculated the 2 – SDs below the control group value to decide the cutoff value below which a LUS thickness could be considered abnormally thin. Our figure 3 mm contrasts with the value reported by Michaels and Coworkers (5 mm) [2]. Fukuda et al considered a sonographic thickness of > 3 mm to represent a healthy scar and thickness of < 2 mm to represent a poorly healed scar [3], although the basis of their conclusion is not mentioned and it was unclear whether a value of 2-3 mm was considered to be normal or abnormal. Similarly, Tanik and Coworkers considered a sonographic thickness of <=3 mm to be abnormal [4]. Rozenberg et al, have reported that the risk of rupture and dehiscence increases progressively when the sonographic thickness of LUS decreases below 3.5 mm [5].

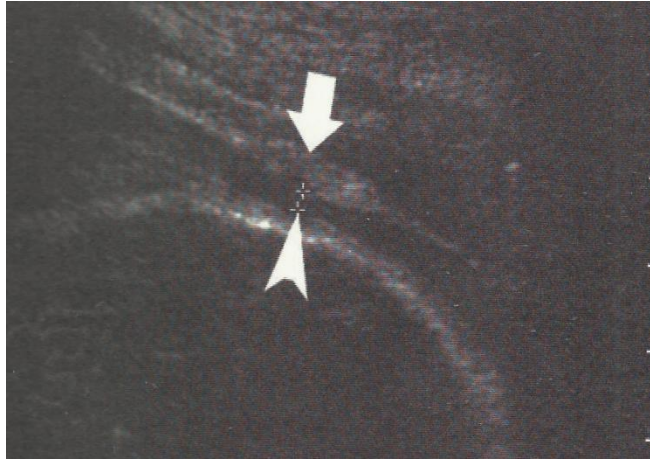


Fig. 3. Longitudinal Sonogram showing an area of increased echogenicity in the outer layer (arrow) with myometrical thinning

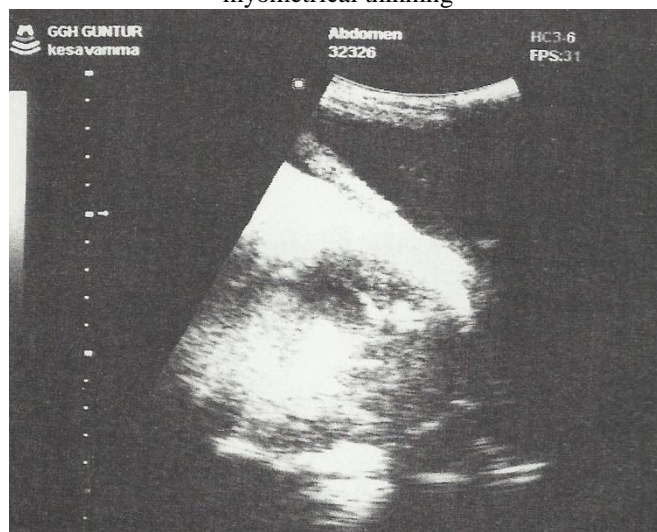


Fig. 4. Longitudinal sonogram showing adhesions to the scar

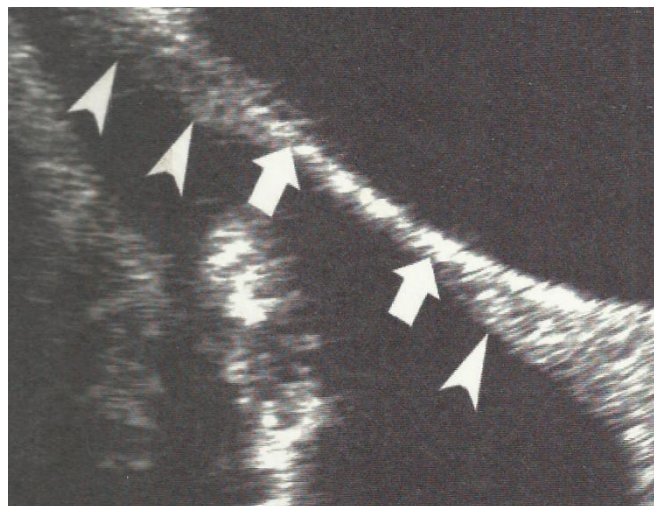


Fig. 5. Longitudinal Sonogram showing uterine defect (between Arrows). The myometrical layer is clearly shown adjacent to the defect ballooning (Arrow heads)

V. Summary

Trans-abdominal ultrasonography (TAUS) was prospectively evaluated for the diagnosis of defects and abnormal thinning of the scarred LUS during the third trimester of pregnancy. 10 primigravidae and 61 women

with a history of 1 previous lower segment Caesarian section were delivered by LSCS and included in the final analysis.

The LUS was significantly thicker in primigravidae group compared with the previous LSCS group, both on ultrasonography (5.4 mm Vs 4.2 mm and $p < 0.004$) and at laparotomy (6.1 mm Vs 5.2 mm and $p < 0.01$).

The specificity and sensitivity of TAUS were 1, the positive and negative predictive values for defects and abnormal thinning were 100%. TAUS of the scarred LUS during the third trimester of pregnancy is useful and reliable for the diagnosis of defects and abnormal thinning.

VI. Conclusion

Most women with a history previous C-section are suitable candidates for TOL-VBAC. One of the most significant risks women face when considering a trial labor is that of uterine rupture. So, careful selection for TOL-VBAC is extremely important. Studies have shown that the risk of uterine rupture in the presence of defective scar is related directly to the degree of the thinning of LUS.

In our study, an LUS with a sonographic wall thickness of $< 3\text{mm}$ is taken as abnormally thin. The results of this prospective study suggest that TAUS is a safe and reliable test with a high degree of specificity and sensitivity to diagnose defects, ballooning and abnormal thinning in the scarred LUS during pregnancy. A single isolated scan during labor is not recommended because of evaluation of the LUS is difficult after descent of the head and membrane rupture.

A large scale study will provide precise information regarding the risk of scar rupture and dehiscence at different values of wall thickness. This will help obstetrician in deciding the cutoff value above which patients may be allowed a TOL-VBAC.

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