RESEARCH STUDY

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Measuring Lower Uterine Segment Thickness Using Abdominal Ultrasound to Predict Timing of Cesarean Section in Women with Scarred Uterus at Elwiya Maternity Teaching Hospital

ARTICLE INFORMATION

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ABSTRACT

Background: Ultrasonography has been used to examine the thickness of the lower uterine segment in women with previous cesarean sections in an attempt to predict the risk of scar dehiscence during subsequent pregnancy. The predictive value of such measurement has not been adequately assessed.
Objectives: To correlate lower uterine segment thickness measured by trans abdominal ultrasound in pregnant women with previous cesarean section with that measured during cesarean section by caliper and to find out minimum lower uterine segment thickness indicative of integrity of the scar.
Methods: A prospective observational study at Elwyia Maternity Teaching Hospital, from January 2011 to January 2012. A total of 143 women were enrolled in the study. Those women who were included were pregnant with gestational age (36-40) weeks, all had history of previous one or more cesarean section. Transabdominal ultrasound measurement of thickness uterine segment thickness done with moderately full bladder before delivery and correlated with these measured directly during operation using a caliper. The sensitivity and specificity of ultrasound calculated with positive and negative predictive value.
Results: The sensitivity and specificity of trans abdominal ultrasound in detecting patient at risk of scar dehiscence in patient with previous and cesarean section not starting uterine contractions were very high 90%and 92% respectively with positive and negative predictive value of 90% and 92% respectively with a cut off value of uterine segment thickness of 4.5 mm. It was also has high sensitivity and positive predictive value of 93.4% and 93% respectively with patients that started labor but with low specificity and negative predictive value of 50% and 38% respectively with the same cut off value.
Conclusions: Sonographic lower uterine segment thickness is a strong predictor for uterine scar defect in women with prior Caesarean section. However, no ideal cut-off value can yet be recommended, whenever uterine contractions started. But this method carries a high sensitivity and specificity in patients who did not start uterine contractions with a cut-off value of 4.5 mm.

Introduction:

There is worldwide increase in the rates of caesarean delivery over the last two decades [1, 2]. The reasons for the continued increase in the cesarean rates are not completely understood. The cesarean delivery rate worldwide is 15 percent of births [3]. Mean cesarean delivery rate in developed countries is 21.1 percent, but is only 2 percent in the least developed countries. In our hospital, Al-Elwyia Maternity Teaching hospital, it was 37.5% during the period from January 2011 to January 2012. The maternal morbidity rate is increased two fold with cesarean delivery compared with vaginal delivery [4]. Clark and colleagues, in a review of nearly 1.5 million pregnancies, found maternal mortality rates of 2.2 per 100,000 cesarean deliveries [5].

Women with prior caesarean delivery have increased rates of uterine rupture in subsequent pregnancy compared with those with only prior vaginal delivery. However the risk of rupture is low (about 0.3%). Significant numbers of women with previous caesarean births end up having repeat caesarean deliveries. In parous women, previous caesarean has been found to be the most common indication for caesarean delivery in as high as 67% of cases [6].

Poorly healed uterine scar might affect the regeneration of the isthmus of uterus and make it thinner [7], resulting in much thinner lower uterine segment scar in subsequent pregnancy. Thin lower uterine segment scar is likely to rupture during labor. Unsecured prediction of the integrity of the scarred lower uterine segment during labor appears to be one of the reasons for repeat caesarean sections (C/S) [8]. Several recent reports suggest that sonographic evaluation of lower uterine segment can be used effectively to assess its integrity to predict the risk of Intrapartum rupture [9, 10].

Different opinions are expressed regarding the period in pregnancy when the ultrasound assessment can be carried out and with regard to the cut of value for lower uterine segment thickness. About timing of sonographic assessment, Quereshi et.al began assessment as early as 16th week of gestation in their study. In contrast, Michael et.al [11], thought it advantageous to assess between 28 and 36 weeks since it allowed for adequate lower uterine segment development, and avoided problems of diagnosis when the presenting part was deep in the pelvis and when the amniotic fluid volume was physiologically reduced[12, 13]. Some have examined women between 36 and 39 weeks of gestation, at time when mode of delivery will be discussed.

Present study is an attempt to determine the lower uterine segment thickness by transabdominal sonography at term pregnancy, correlate it with manual caliper measurements at caesarean delivery and find out predictive value of lower uterine segment thickness measurement in assessing integrity of lower uterine segment in women with previous caesarean delivery. Preliminary studies suggest that sonographic evaluation of the uterine scar may hold some promise for identifying women at risk [14]. Ultrasound exams do not use ionizing radiation (as used in x-rays) and is a noninvasive medical test.

Methods:

The present study is a prospective observational study conducted at Al-Elwyai Maternity Teaching Hospital, Baghdad- Iraq, from January 2011 to January 2012.

During the period of the study 13643 women were delivered in our department, from those 5117 were delivered by C/S and 3531 of them were with repeated C/S. Two hundred patients were selected in the initial assessment of eligibility for the study, and only 143 pregnant women with previous history of one or more C/S who were eligible for our study according to the following inclusion and exclusion criteria were enrolled.

Inclusion criteria:

1. Patients with singleton pregnancy.
2. Gestational age 36-40 weeks.
3. Normal amount of liquor.
4. Normal placental site.
5. Have one or more previous C/S.
6. Presenting by vertex.

Exclusion criteria:

1. Patients with multiple pregnancies.
2. Patients with preterm deliveries.
3. Polyhydrominia or oligohydraminia.
4. Low lying placenta.
5. Fetal congenital abnormality.
6. Patients with history of uterine surgery other than C/S.
7. Malpresentation.

A formal questionnaire filled for each woman including her informed consent of participation and a careful history taking including accurate dating by last menstrual period according to Naegle's rule [15], and gestational age confirmation by early ultrasound (U/S), number of previous scars, timing and interval between previous C/S, indication of C/S, any complication during operation, a thorough physical, abdominal, obstetrical and vaginal examination at time of admission to assess uterine contraction and fetal condition. Obstetric U/S was done for gestational age, amount of liquor, placental site, and fetal wellbeing and to exclude any malformation. These patients were assigned as group (A) or (B), where:

1. Group (A): 97 women started contractions, so needed urgent C/S.
2. Group (B): 46 women did not start contractions, but needed elective C/S.

Prospective sonographic assessment of lower uterine segment (LUS) was carried out for these patients. few hours before delivery ante partum abdominal sonography was performed with moderately full bladder. For the purpose of the study, bladder was considered to be moderately full when abdominal scan revealed bladder length of 6-8 cm in vertical plane.

At abdominal sonography the LUS was considered abnormal if any of the following were present: abnormally thin LUS<1mm, asymmetry of LUS(when there was difference of at least 2mm between two measurements), abnormal movement, ballooning or wedge defect in the LUS.

U/S examinations were performed by designated obstetrician-sonologist who was not involved in the management of the cases. The examination was done by ultrasound with convex transducer frequency of 3.5 MHz (Braun, U.K) at the Radiology department for an obstetric ultrasound scan. The thickness of the anterior wall of the LUS where it covers the fetal head was measured as a distance from posterior wall of the bladder wall interface to uterine wall amniotic fluid interface.

Gentle pressure was applied by transducer against maternal abdomen to move LUS. Any movement that distorted the shape of the LUS was considered abnormal. Note was made of any asymmetry of the thickness resulting in wedge defect and anterior bulging of the fetal membranes suggestive of scar dehiscence.

During the operation under general or spinal anesthesia the actual measurement of LUS thickness was recorded using Vernier calipers. Thickness of the lower flap of LUS at center measured before delivery of fetal head was used for correlating with sonographically measured LUS thickness.

The results of the study were analyzed statistically by using the following procedures:

1. Descriptive statistics: Statistical tables including observed frequencies with their percentages (Cross tabulations).
2. Evaluating the validity of the US when compared with the standard tests (post operative). Data were analyzed using the following procedure:-The sensitivity and specificity are two measures of the validity of a screening test.

Results:

The incidence of cesarean section was 37.5%, 69% of them were with repeated C/S. The rate of scar dehiscence was 1.75% among patients with repeated C/S. 143 patients with history of repeated C/S were conducted in our study. The thickness of LUS measured by U/S among this group of women ranged from (1.6-12 mm). We observed that the rates of scar dehiscence correlated inversely with the LUS thickness. As the LUS thickness decrease the rate of scar dehiscence increase with a cut off value 4.5mm as shown in the table.1.

Table1: Relation between LUS thickness and rate of dehiscence.

LUS Thickness (mm)	Number of cases	Dehiscence and paper like LUS No. (%)	Scar dehiscence No. (%)
>4.5	31	0(0%)	0(0%)
3.6 - 4.5	45	10(22.2%)	2(4.4%)
2.6 - 3.5	44	13(29.5%)	1(2.2%)
1.6 - 2.5	23	8(34.8%)	1(4.3%)

From those patients the rate of scar dehiscence and paper like LUS was 18% and the rate of scar dehiscence was 2.2%. We found that the use of U/S in measuring LUS thickness in group A in determining time of delivery is useful with high sensitivity of about 93.4% but low specificity of about 50%. The positive predictive value was 93% and the negative predictive value was 38% as shown in table 2.

Table 2: Predictive value of U/S in group A.

Type of Measurement	Number of cases		
	≤4.5 mm	>4.5 mm	total
LUS thickness by U/S	85	12	97
LUS thickness by caliper	91	6	97

We observe that the use of U/S in measuring LUS thickness is useful in group (B) with high sensitivity 90%, high specificity 92.8%, positive predictive value 90% and negative predictive value 92% as shown in table 3.

Table 3: Predictive value of U/S in group B.

Type of Measurement	Number of cases		
	≤4.5 mm	>4.5 mm	total
LUS thickness by U/S	18	28	46
LUS thickness by caliper	20	26	46

From the 143 patients 35 cases were with and paper like LUS and scar dehiscence. According to number of previous C/S the rate of scar dehiscence increase as the number of repeated C/S increase as shown in table no.4.but the p value was 0.234 which is statistically non significant.

Table 4: Relation between numbers of repeated C/S and rate of dehiscence.

Number of previous C/S	Number of cases	Defective scar No. (%)	P value
1	35	5(14%)	
2	52	11(21%)	
3	34	8(23%)	0.234
4	15	4(26%)	
5	7	3(42%)	

We correlated between the interval between last 2 pregnancies and the thickness of LUS as shown in table no. 5. In group A the p value was 0.035 which is statistically significant but in group B the p value was 0.191 which is statistically not significant.

Table 5: Association between Duration from last C/S and scar dehiscence.

	Groups	Duration from last C/S (Months)		
		12	13-23	>24
A	All No.	20	51	26
	Dehiscent No. (%)	6(30)	14(27.4)	1(3.8)
	p-value		0.035	
B	All No.	5	33	8
	Dehiscent No. (%)	1(20)	6(18.2)	2(25)
	p-value		0.191	

Also we correlate the gestational age and the LUS thickness as in table no. 6. The p value in group A was 0.21 and in group B was 0.8 which both were statistically not significant.

Table 6: Association between gestational age and scar dehiscence

	Groups	Gestational age (days)			
		252-258	259-265	266-272	273-280
A	All No.	4	20	30	43
	Dehiscent No. (%)	1(25)	2(10)	3(10)	15(35)
	p-value		0.21		
B	All No.	0	9	25	12
	Dehiscent No. (%)	0(0)	2(22)	1(4)	6(50)
	p-value		0.8		

Discussion:

Over 90 percent of women who undergo cesarean delivery have a repeat procedure in subsequent pregnancies [1]. The rate of scar dehiscence in our hospital was 1.75% while the rate of scar dehiscence among patients included in this study was 2.2% and for the purpose of the study we included the cases with paper like LUS which were less than 1 mm, the rate of scar dehiscence and paper like LUS was 18%. Assessment of the lower uterine segment scar integrity thus becomes important and it has become possible with the availability of ultrasonography [7].

In some studies, the entire LUS by transabdominal U/S was measured while in others, only the middle muscle layer was assessed using transvaginal U/S and some studies used both approaches [16]. Michael's et.al, were the most important authors that report an accurate method for diagnosing the presence of uterine defects or documenting their absence should be clinically useful by using U/S to examine the LUS thickness [17].

Rozenberg et.al, found that LUS thickness correlated inversely with the risk of rupture and concluded that

thickness more than 3.5 mm is protective against rupture. Although the sensitivity and positive predictive value of the thin segment for a defective scar were low, the negative predictive value of the thick segment was high. Other reports using 3 mm as cut of validated similarly [18]. Bujold et.al [10], using receiver operator curve analyses opined that full LUS thickness of <2.3 mm was associated with higher risk of complete uterine rupture. On the other hand, measuring only the myometrial layer instead of full LUS thickness, Asakura et.al [19], concluded that if the myometrial layer was 1.6mm or more, it is protective against rupture. These findings are supported by those of Cheung [20] and Gotoh et.al [21], who suggests a myometrial layer more than 1.5 and 2 mm, respectively, as a cut off value. By Qureshi et.al [22], a prospective randomized study was conducted to measure the serial thickness of the lower uterine segment (LUS) by trans-vaginal ultrasonography in a control group of 80 women having no history of uterine surgery and in a study group of 43 women having a history of previous cesarean section. In the study group, more than 2 mm thickness of the LUS was considered as a good healing and less than 2mm thickness as a poor healing. After serial sonographic examination, the women with good healing were given a trial for labor unless an indication for C/S existed. Montanari et.al [23], found that the transvaginal Sonographic examination improves the obstetrical decision-making regarding the trial of labor in women with previous CS, as it provides sensitivity and specificity of 100% and 75% respectively, for a thickness cut-off of 3.5 mm and a positive and negative predictive value of 60.7% and 100% respectively.

Our findings indicate that there is a strong association between the degree of LUS thinning measured near term and the risk of uterine scar defect at birth. The 4.5mm cut-off value for full LUS thickness was best validated, with 143 cases analyzed in our study. In group (A), although this cut-off demonstrated a high sensitivity and a strong positive predictive value for uterine scar defect, it had weak specificity. Therefore, there is actually no ideal cutoff value that can be recommended for clinical purposes, even if the association of LUS thickness and uterine scar defect is strong. In group (B) this cut-off value demonstrated a high sensitivity and a strong PPV for scar defect with high specificity and NPV. So it can be recommended for clinical purposes as long as no uterine contraction started. While the evaluation of the relationship between the scar thickness and duration since last C/S, we notice that the highest rate of thin scar and scar dehiscence was for inter pregnancy interval of less than 12 months however this did not reach a statistically significant value in group B (p-value 0.191) but in group A it was statistically significant (p- value 0.035) which mean that it is strongly associated with scar dehiscence in cases that started uterine contractions.

A number of studies have demonstrated that the risk of rupture varies inversely with the interval between the last C/S and next pregnancy and considered it to be risk factor for uterine scar dehiscence and rupture. In Kantor et.al study [24], data show no dependency of period of time from (1-4years) following a previous C/S with the frequency of dehiscence and paper lower segment. It seems important to advice the patients to wait for her next pregnancy for few years following C/S as there is remarkably low ratio of dehiscence and paper lower segment in women giving birth within a year following a C/S, this may correlate with the highest percentage of elective C/S. In this study we used the sonographic measurement of lower uterine segment thickness at around (36-40) weeks in pregnant women with scarred uterus to predict the risk of uterine rupture. We found that there is no significant association between the gestational age and the defects in the LUS. If elective cesarean is planned, it is essential that the fetus be mature.

Significant and appreciable neonatal morbidity has been reported with elective delivery prior to 39 completed weeks [25]. Newborns delivered by planned or scheduled cesarean are at increased risk of respiratory and other morbidity compared with newborns delivered vaginally or by emergency cesarean [26], and as there is no significant association between gestational age and uterine scar dehiscence we can wait until 39 weeks unless uterine contractions started after doing an ultrasonic examination for assessment of LUS thickness.

Conclusions:

Sonographic LUS thickness is a simple test and also it is a strong predictor for uterine scar defect in women with previous Caesarean section. However, no ideal cut-off value can yet be recommended, whenever uterine contractions start. But this method carries a high sensitivity and specificity in patients who did not start uterine contractions with a cut-off value of 4.5 mm.

Recommendations:

1. We recommended doing transabdominal U/S to measure the LUS thickness for each pregnant lady with previous C/S starting from 36 weeks.
2. Further studies need to be done starting from earlier GA and using transvaginal U/S.
3. Every patient should have a proper discharging card including the details of the operation.

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