International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Ikoro C et al. Int J Reprod Contracept Obstet Gynecol. 2023 Jan;12(1):44-51
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20223473

Original Research Article

Lower uterine segment scar thickness as a predictor of successful vaginal birth after caesarean section at the Federal Medical Centre, Yenagoa: a prospective cohort study

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Received: 23 November 2022
Accepted: 12 December 2022

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ABSTRACT

Background: Successful conduct of vaginal birth after caesarean section is dependent on a number of foetal and maternal factors including integrity of the previous caesarean section scar. The objective of this study was to determine the average lower uterine segment (LUS) scar thickness for women being planned for VBAC.
Methods: This was a prospective cohort study of pregnant women with one previous caesarean section, who were recruited to undergo transvaginal ultrasound scan in preparation for VBAC at the Federal Medical Centre (FMC) Yenagoa. It was conducted between May, 2018 and September 2019. The women were allocated into three groups A (<2.5mm), B (2.5-3.4 mm) and C (≥3.5 mm) according to the thickness of the LUS scar. Data analysis was done using the statistical product and service solutions version 22.0, $p<0.05$ was taken as statistically significant.
Results: The range of lower uterine segment thickness in the study was 1.5 mm to 6.8 mm (mean 3.89±0.95 mm). With cut-off value of 3.5 mm, the sensitivity for successful VBAC was 78.8%, specificity was 55.4%, PPV was 78.1%, NPV was 62.0% and accuracy was 71%. The rate of uterine defect increased as the lower uterine segment thickness decreased from 3.5 mm ($p=0.001$).
Conclusions: This research has clearly shown that full LUS thickness of ≥3.5 mm at 36 weeks of gestation is associated with an increased chance of successful VBAC while LUS thickness of <3.5 mm is at increased risk of uterine rupture and uterine dehiscence during a Trial of VBAC.

Keywords: VBAC, LUS, Caesarean section, Scar thickness

INTRODUCTION

For a long time, the presence of scar on the uterine wall seemed to override all else and Cragin's dictum shaped obstetric practice: "once a caesarean, always a caesarean".[1] As the procedure was developed further and various modifications were introduced, people felt bolder to try vaginal birth after caesarean (VBAC) and the obstetric literature is replete with articles that have reported the experience with this approach in several parts of the world. Yet the mindset of 'the scar' being the all-important factor still dominates the thinking of many obstetricians and an attempt at VBAC often referred to as trial of scar. When the uterus is scarred in a woman from previous caesarean section, much care is needed in subsequent monitoring of such parturient in labour. There is a significant need for ultrasonographic measurement of the lower uterine segment scar. However, the predictive

value of such measurement has not been specifically validated.

Caesarean section (CS) rates have increased both in the developed and developing countries. Some of the reasons are greater availability of surgical skills, safer anaesthesia, excellent blood transfusion services, advances in operative technology and availability of potent and broad-spectrum antibiotics.[2] The number of patients who are faced with the challenge of deciding between a VBAC and a repeat CS increase just as the incidence of caesarean section rises. Concomitantly there is decreasing trend among obstetricians towards trial of VBAC and a rising CS rate.[3] There is evidence that VBAC is safe in appropriately selected women in addition to adequate intrapartum monitoring and ready access to CS when emergency CS is indicated.[3]

Elective procedures are occasionally conducted for relative indications. CS are also demanded by some women in preference to vaginal delivery even when they can successfully deliver vaginally. These need to be controlled in order to curtail the increasing high rates of CS. Caesarean sections are actually more expensive and associated with some risks to the mother and even to the baby despite all the recent advances.[3] The rising rate of CS has created an expanding high risk obstetric subpopulation hence a lower threshold for a repeat caesarean section in developing countries.[4] Some women with scarred uteri however have aversion for repeat CS even when indicated. Hence, they are less willing to consent to repeat Caesarean sections. Previous CS is the highest indication of repeat CS in Nigeria.[5] In Nigeria and other West African countries, many obstetricians would consider a history of two or more previous CS as an absolute indication for repeat CS, but evidence accumulated over time suggests that this needs not be so, and there are now some reports that suggest that safe VBAC can be achieved in carefully selected few of such patients.[6]

To our knowledge, there are no reliable methods to predict the risk of uterine rupture in these groups of patients hence preventing successful VBAC.[7] A most dreaded and serious complication of trial of VBAC is uterine rupture, hence vaginal birth after CS is offered to only those who have been cautiously selected based on certain prerequisites and clinically favourable factors. These clinical factors are important as well as CS scar integrity and thickness of lower uterine segment assessed by ultrasonography to predict successful VBAC or risk of uterine scar dehiscence or rupture which may happen spontaneously or during trial of vaginal birth after previous CS.

There are some limitations on using only clinical variables to predict successful VBAC, uterine scar dehiscence or uterine rupture. Some of the clinical factors are indications for the previous CS, type of uterine incision, morbidities following the surgery such as puerperal sepsis with endometritis, short inter-pregnancy interval and foetal macrosomia in the index pregnancy. Spontaneous labour, gravidity, parity, prior vaginal delivery are also factors associated with successful vaginal birth after caesarean delivery.[8] All these clinical factors have not been completely demonstrated to be useful alone or in combination in absolutely predicting good outcome of a VBAC or an adverse outcome.[8,9] Serious maternal morbidity increases progressively with increasing number of Caesarean deliveries. Ultrasonography has been used to examine the scarred uterus in women who have had previous Caesarean sections in an attempt to assess the success of VBAC or risk of rupture of the scar during subsequent labour.[10] The objectives of this study was therefore, to do ultrasonographic assessment of lower uterine segment scar thickness at 36 weeks GA and determine the relationship of the average thickness with successful VBAC, to determine the average thickness of lower uterine segment at 36 weeks GA of women being planned for VBAC, to determine the relationship of lower uterine scar thickness and successful VBAC, and to determine the relationship of lower uterine segment scar thickness and occurrence of uterine scar dehiscence or uterine rupture.

METHODS

Study design, duration, location and population

This was a prospective cohort study conducted from May 2018 to September 2019. This study was conducted at the Obstetrics and Gynaecology department with the Radiology department of the Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria. This hospital is one of the two tertiary health institutions in Bayelsa State. Study group consisted of pregnant women with one previous lower segment CS who satisfied the inclusion criteria for trial of VBAC. They were recruited into this study after obtaining written informed consent from them.

Inclusion criteria

Inclusion criteria for current study were; women with one previous lower uterine segment CS; non-recurrent indication for previous CS e.g., malpresentation, foetal distress, severe preeclampsia with unfavourable cervix and placenta praevia; uncomplicated previous CS like wound sepsis or wound breakdown; women with interpregnancy interval of greater than or equal to 15 months; women with singleton foetus with cephalic presentation at the time of selection at 36 weeks gestation; estimated foetal weight (EFW) of less than or equal to 3.5 kg by radiological assessment; women with no co-existing chronic medical condition; EGA of 36 weeks, women who gave consent.

Exclusion criteria

Exclusion criteria for current study were; Women with more than one previous CS, previous classical CS, recurrent indication for CS, previous CS complicated by

wound sepsis and/or wound breakdown, women with interpregnancy interval less than 15 months, multiple pregnancy, abnormal lie or presentation in index pregnancy at the time of selection at 36 weeks, estimated foetal weight (EFW) greater than 3.5 kg by radiological assessment, women with any co-existing chronic medical condition, EGA less than 36 weeks or greater than 36 weeks at the time of selection, women who did not give consent.

Sample size determination

Sample size was determined using the formula:

$$n = z^2 pq / d^2$$

Where, n = minimum sample size**,** z = normal standard deviation set at 95% confidence limit = 1.96**,** p = proportion of women that had Caesarean section from a previous study was 27.6%**,** q = 1 – p (complementary probability) d = margin of error = 5% = 0.05.[5] A minimum sample size of 338 was calculated. Therefore, 338 women were recruited for the study.

Sampling method and patient selection

Simple random sampling was done where all pregnant women with one previous CS attending the antenatal clinic were counselled about the study. Those who met the inclusion criteria and gave consent were recruited for the study. Informed consents were obtained from them just before or at 36 weeks GA. All patients enrolled had transvaginal ultrasound done to assess the thickness of the lower uterine segment scar at 36 weeks gestational age. When they presented in labour, they were admitted to the labour ward for trial of VBAC. These women were consecutively recruited until the sample size was attained.

Procedure

Transvaginal ultrasound scan examinations were performed at 36 weeks' gestational age. The urinary bladder was emptied to ensure adequate visualisation of the LUS. The sonographic examination included identification of foetal presentation, amniotic fluid volume estimation and placenta localization. Ultrasonography of the myometrial thickness and full lower uterine segment thickness (mLUS and fLUS respectively) were done using a four-dimensional transvaginal probe adjusted to 7.5-MHz. Sonographically, the fLUS is a two-layer structure that consists of an echogenic layer (including the bladder wall) and a layer that is usually less echogenic (considered to represent the myometrium, mLUS).[12] Once the area of myometrium was identified, the image was magnified up to two-third of the screen and frozen. The LUS scar thickness was then measured. Any ballooning effect seen was identified and documented.[13] Attempts were made to identify the previous uterine scar and the appearances noted. On the lower uterine segment, the thinnest zones were identified and measured at the mid-sagittal plane along the cervical canal.[12] The area was magnified such that any slight movement of the calliper produced a change in measurement by only 0.1 mm. Measurements of the full thickness of LUS were taken thrice with the cursors at the urinary bladder wall-myometrium interface and the myometrium/chorioamniotic membrane-amniotic fluid interface. The mean was obtained and taken as the lower uterine segment thickness of the study. The study enrolees were divided into group A (<2.5 mm), group B (2.5-3.4 mm) and group C (≥3.5 mm) depending on the value obtained. The managing Obstetricians and patients were blinded to the sonographic results so as not to have any bias in decisions for vaginal delivery or elective CS. At onset of spontaneous labour at term the participants were admitted into the labour ward. Augmentation of labour was allowed cautiously where indicated. At least two units of blood were grouped and cross matched which is a departmental protocol. Intravenous line with a size 16 -18-gauge cannula was established. The theatre was informed for possibility of CS. The anaesthetists and neonatologists were adequately informed too. There was continuous electronic foetal monitoring as well as partographic monitoring and documentation of foeto-maternal signs. Recourse to CS were for obstetric indications and were done specifically by senior registrars and/or consultants. After successful vaginal delivery, babies were handed over to the neonatologist who assessed the neonates. The participants were carefully examined too. Any episiotomy given was repaired promptly. Any adverse foeto-maternal outcome post-delivery were noted and documented. An information sheet was used for data collection which contained the socio-demographic characteristic of each participant, activities surrounding the previous CS as well as pre-, intra - and post-delivery events of each index pregnancy of each patient. The estimated LUS thickness of each patient was entered into the information sheet. The post-delivery foeto-maternal conditions were assessed and noted. All collected information and activities were promptly and properly documented before transfer to computer spread sheet.

Measures of outcome

The primary outcome was successful VBAC in relation to lower uterine segment scar thickness, while the secondary outcome was recourse to abdominal delivery with or without unfavourable outcome (e.g., uterine scar dehiscence, uterine rupture, foeto-maternal morbidities, stillbirth). For those in whom recourse to CS became inevitable, the obstetricians at surgery categorized the lower uterine segment into: Grade I: Well-developed lower uterine segment. Grade II: Thin lower uterine segment but without visible content. Grade III: Translucent lower uterine segment with visible content (dehiscence). Grade IV: Well circumscribed defects, either uterine scar dehiscence or rupture.[12]

Data analysis

The data obtained from the study was entered into the Statistical Product and Service Solutions (SPSS) version 22.0 software (SPSS Inc, Illinois, USA). The socio-demographic variables (age in years, parity, educational level) were analysed using descriptive statistics like mean and standard deviation (if numerical) and percentage (if categorical). The primary outcome was presented as proportion. The test of association between obstetric profile and other determinants of primary outcome was done using the chi-squared test and the Fisher's exact test (where the proportion of expected frequencies <5 is more than 20%). Some predictors used in the model included age, parity, gestational age at delivery, type of previous CS (elective or emergency), LUS thickness, bishop score, augmentation of labour, p <0.05 was taken as statistically significant. Frequency distribution tables and charts were used to present the result.

RESULTS

In the period under review, 2,200 pregnant women were delivered of their babies in our centre. Six hundred and sixteen (28%) had scarred uteri, out of which 338 (54.8%) of the women were recruited for this study. Participants' age ranged between 19-40 years with a mean of 27.7±4.0 years. Those employed were 191 (56.5%) while 147 (43.5%) were unemployed. Parity ranged between 1 and 5 (median 2). One hundred and eighty-eight (55.6%) women had tertiary level of education. As parity increased, the number of women with scarred uterus recruited in the study decreased (Table 1).

Table 1: Sociodemographic characteristics of study participants (n=338).

Characteristics	N	%
Age of participants (years)		
<20	12	3.6
20-24	98	29.0
25-29	125	37.0
30-34	71	21.0
>34	32	9.4
Level of education		
No formal education	6	1.8
Primary education	31	9.2
Secondary education	113	33.4
Tertiary	188	55.6
Occupation		
Employed	191	56.5
Unemployed	147	43.5
Parity		
1	134	39.6
2	91	27.0
3	78	28.0
≥4	35	10.4

Table 2: Distribution of obstetric parameters among study participants (n=338).

Obstetric Parameter	N	%
Interpregnancy interval (months)		
15-18	121	35.8
19-24	134	39.6
>24	83	24.6
Stages of labour of primary CS		
Elective	128	37.9
1st stage	176	5.0
2nd stage	34	10.1
Gestational age (GA) at delivery (weeks)		
37	102	30.2
38	109	32.2
39	66	19.5
≥40	61	18.1
Bishop score at admission		
Unfavourable (≤5)	61	18.0
Favourable (≥6)	277	82.0
Augmentation of labour		
No Augmentation	276	81.7
Augmentation of Labour	62	18.3
Lower uterine segment (LUS) thickness (mm)		
A (≤ 2.5)	31	9.2
B (2.6-3.5)	79	23.4
C (≥3.6)	228	67.4
Trial of VBAC outcome		
Successful VBAC	226	66.9
EMCS	112	33.1
LUS Grading at caesarean section		
Grade 1	74	66.1
Grade 2	29	25.9
Grade 3	6	5.3
Grade 4	3	2.7

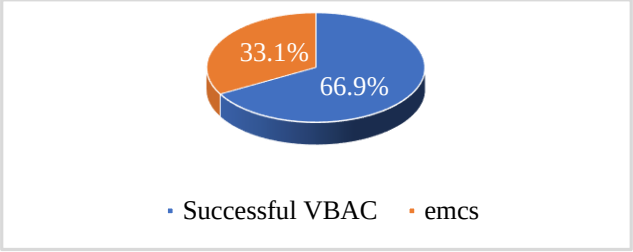

Figure 1: Outcome of trial of VBAC.

Participants with successful VBAC were 226 (66.9%). Those that had emergency CS were 112 (33.1%) as depicted in (Table 2, Figure 1). Ultrasound scan measurement of the LUS scar thickness ranged between 1.5 mm to 6.8 mm (mean 3.89±0.95 mm). GA at delivery ranged between 37.1-41.1 weeks (mean 39.6±0.73 weeks). The different LUS gradings at CS are represented in (Figure 2).

The frequency of successful VBAC was directly proportional to the increasing lower uterine segment scar thickness.

Table 3: Association between lower uterine segment scar thickness and trial of VBAC outcomes among study participants (n=338).

LUS scar thickness (mm)	Total Frequency (%)	Trial of labour outcome		x^2	df	P value
		VBAC (N=226) Frequency (%)	EMCS (N=112) Frequency (%)			
A (≤2.5)	31 (9.2)	9 (29)	22 (71)	43.86	2	0.001
B (2.6-3.5)	79 (23.4)	39 (49.4)	40 (50.6)			
C (≥3.6)	228 (67.4)	178 (78.1)	50 (21.9)			

Table 4: Association between uterine defect and LUS scar thickness, type of CS and trial of VBAC outcomes (n=338).

Characteristics	Total Frequency (%)	Rupture/dehiscence		X^2	df	P value
		Present (N=9) Frequency (%)	Absent (N=329) Frequency (%)			
LUS scar thickness (mm)						
A (≤ 2.5)	31 (9.2)	5 (16.1)	26 (83.9)	53.01	2	0.001
B (2.6 – 3.5)	79 (23.4)	3 (3.8)	76 (96.2)			
C (≥ 3.6)	228 (67.4)	1 (0.4)	227 (99.6)			
Type of Previous CS						
Elective	101 (29.9)	2 (22.2)	99 (30.1)	0.26	1	0.929
Emergency	237 (70.1)	7 (77.8)	230 (69.9)			
Trial of VBAC outcome						
Successful VBAC	226 (66.9)	0 (0.0)	226 (68.7)	17.07	1	0.001
Emergency CS	112 (33.1)	9 (100.0)	103 (31.3)			
Augmentation of labour						
Augmentation	62 (18.3)	6 (66.7)	56 (17.0)	14.37	1	0.001
No augmentation	276 (81.7)	3 (33.3)	273 (83.0)			

Table 5: Indication for emergency caesarean section (n=112).

Indication	N	%
Suspected foetal distress	12	10.7
Cephalopelvic disproportion	55	49.1
Intrapartum haemorrhage	11	9.9
Poor progress in labour	31	27.6
Cord presentation and cord prolapse	3	2.7

Table 6: Relationship between LUS gradings at surgery and ultrasonographic lower uterine segment thickness.

LUS scar thickness (mm)	Total	LUS grading at Caesarean section, N (%)			
		Grade I	Grade II	Grade III	Grade IV
Total N (%)	112 (100)	74 (66.1)	29 (25.9)	6 (5.3)	3 (2.7)
A (≤ 2.5)	22 (19.7)	12 (16.2)	5 (17.2)	2 (33.3)	3 (100.0)
B (2.6-3.5)	40 (35.7)	28 (37.8)	9 (31.1)	3 (50.0)	0 (0.0)
C (≥ 3.6)	50 (44.6)	34 (46.0)	15 (51.7)	1 (16.7)	0 (0.0)

Out of 31 women in A (≤2.5 mm) category, 9 (29.0%) had successful VBAC while 22 (71%) had emergency CS. Women with successful VBAC in B (2.6-3.5 mm) category were 39 (49.4%), while 40 (50.6%) had emergency CS out of 79 women. In C (≥ 3.6 mm) category, 178 (78.1%) out of 228 women had successful VBAC while a much lesser number 50 (21.9%) had emergency CS (p=0.001) (Table 3).

The rate of uterine defect increased as the lower uterine segment scar thickness decreased. Only 1 (0.4%) out of the 228 women in C (≥3.6 mm) category had LUS scar dehiscence (LUS grade 3). Out of 79 women in the B (2.6 - 3.5 mm) category, there were 3 (3.8%) cases of uterine scar dehiscence. Among the 31 women in A (≤2.5 mm) category, there were 5 (16.1%) cases of uterine defects (2 scar dehiscence and 3 uterine rupture) (Table 4). Of the 112 (33.1%) women that had emergency CS, 12 (10.7%) cases were due to suspected foetal distress. Other

indications for emergency CS were cephalo-pelvic disproportion 55(49.1%) intra partum haemorrhage 11 (9.9 %), poor progress of labour (after 8 hours in active phase of labour) 31 (27.7%) cord presentation and cord prolapse 3 (2.7%) (Table 5).

The LUS grading at CS was directly proportional to the ultrasonographic LUS thickness. The total number of participants who had uterine defects were 9 (2.7%) out of which 6 (1.8%) were cases of uterine scar dehiscence and 3 (0.9%) were uterine rupture (from the total participants of 338 women). However, the LUS grading of the 112 participants at surgery were grade I = 74 (66.1%), grade II = 29 (25.9%), grade III = 6 (5.3%) and grade IV = 3 (2.7%) as depicted in (Figure 2, Table 6).

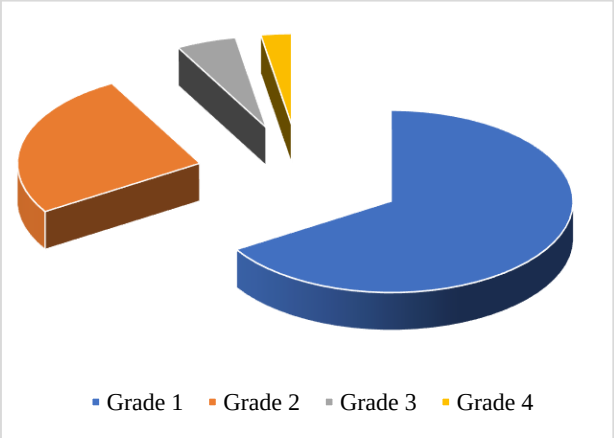

Figure 2: Lower uterine segment grading at caesarean section.

Table 7: Predictive Accuracy of lower uterine segment scar thickness at different cut-off points for successful VBAC and occurrence of uterine defect.

Predictive properties	Cut-off points	
	2.5 mm (%)	3.5 mm (%)
Successful VBAC		
Sensitivity	96.0	78.8
Specificity	19.6	55.4
Positive predictive value	70.7	78.1
Negative predictive value	70.9	62.0
Accuracy	70.7	71.0
Occurrence of uterine defect		
Sensitivity	55.6	88.9
Specificity	92.1	69.0
Positive predictive value	16.1	7.3
Negative predictive value	92.1	99.6
Accuracy	91.1	69.5

The predictive accuracy of LUS scar thickness for successful VBAC and uterine defect respectively at different cut-off points is shown in (Table 7). With the cut-off of 2.5 mm, the sensitivity was 96%, specificity was 19.6%, PPV was 70.7%, NPV was 70.9% and accuracy was 70.7%. With the cut-off value of 3.5 mm to predict successful VBAC, the sensitivity was 78.8%, specificity was 55.4%, PPV was 78.1%, NPV was 62.0% and accuracy was 71% (Table 7).

DISCUSSION

Lower uterine segment scar thickness radiologically assessed at 36 weeks' GA in women with a previous CS has been seen in this study and other studies to be associated with the outcome of VBAC. The VBAC success rate of this study was 66.9%. This rate corresponds with present literature, in which the rate of successful VBAC varies from 52% to more than 80%.[6,13] Success rate in the developed world hovers around the 80% range. But in West Africa the success rate is closer to 60%.[6] The difference probably results from patient selection, advanced methods of monitoring labour like the use of intrauterine pressure catheter and quicker decision-operation time in patients undergoing trial of VBAC.

The range of lower uterine segment thickness from this study was 1.5 mm to 6.8 mm with mean of 3.89±0.95 mm. This rate is comparable to other studies. Umelo et al in 2014 in Irrua, Edo State, Nigeria observed lower uterine segment thickness of 1.6 to 6.6 mm (mean of 3.53±0.97 mm where 153 women at 35-37 GA were recruited. Four categories were used ≤2.5, 2.6-3.5, 3.6-4.5 and ≥4.6 mm in their study.[10] Kok et al in 2013 found that a full lower uterine segment thickness cut-off of 3.1-5.1 mm provided a strong negative predictive value for occurrence of uterine defect or successful VBAC.[14] Comparison was however difficult because of study heterogeneity. Jastrow et al in 2011 did ultrasonographic measurement of lower uterine segment at 35-37 GA and concluded that LUS scar thickness cut-off of 2.0 to 3.5 mm for full LUS scar thickness measured by abdominal ultrasonography prior to delivery at term for women with previous CS is suggestive of stronger LUS scar for successful VBAC, but that it was not a reliable safeguard for trial of VBAC. Some other prerequisites are equally important.[15] Transabdominal route of ultrasonography was used which might have had a drawback. Rosenberg et al introduced measurement of LUS scar thickness with the 3.5 mm cut-off with transvaginal ultrasonography into practice after their observational study.[16]

This study also revealed the outcome of VBAC trials and its comparison to other studies. The women that had emergency CS in category A (≤2.5 mm), had 5 cases of uterine defects (3 uterine ruptures and 2 uterine scar dehiscence. Grade IV LUS was also seen at surgery in this category of women. In category A (≤2.5 mm), where there was thinnest LUS scar by ultrasonographic measurement, there were 3 (100%) grade IV surgical LUS and 2 (33.3%) grade III surgical LUS seen at surgery whereas category B (2.6-3.5 mm) had no grade IV LUS but there were 3 (50%) grade III surgical LUS

and 9 (31.1%) surgical grade II LUS. The rest were grade 1 surgical LUS. Category C (≥3.6 mm) had no grade IV LUS at surgery but had 1 (16.7%) grade III LUS, and 15 (51.7%) grade II LUS. The rest were grade 1 LUS (44.6%). Hence 3.5 mm is regarded as reasonable cut-off value.

The outcome of our VBAC trial is also comparable to the study of Umelo et al where out of 153 women who had transvaginal ultrasonographic assessment of LUS scar thickness at 35-37 weeks' GA, 103 (67.3%) had successful VBAC while 50 (32.7%) had emergency CS.[10] There were 6 (3.9%) of uterine defects, 2 (1.3%) were uterine ruptures while 4 (2.6%) were uterine scar dehiscence. The higher the LUS scar thickness, the higher the number of women with successful VBAC. The LUS scar thickness was also inversely proportional to the rate of uterine defect. In their study 5 (83.3%) of the 6 cases of uterine defects with surgical LUS grade III or IV occurred when LUS scar thickness was 3.5 mm or less and only 1 (16.7%) in the group with 3.6-4.5 mm LUS scar thickness. There was no surgical grade III or IV with LUS scar thickness of ≥4.6 mm. Based on this, LUS thickness of 3.5 mm was also considered by Umelo et al as good cut-off for identification of women at risk of LUS grade III or IV with sensitivity of 83.3% and NPV of 99.2%. This is comparable to sensitively of 88.9% and NPV of 99.6% of this study using 3.5 mm as a cut-off for predicting successful VBAC and risk of uterine defect.

Cut-off of LUS for successful VBAC in some studies ranged from 2.0-3.5 mm (this is for the entire LUS thickness). Some researchers used only the myometrial layer which ranged between 1.4-2.0 mm. This was more difficult and did not tally with values of most researchers.[15,17] Jastrow et al observed that a cut-off value of 3.5 mm has sensitivity of 88%, specificity of 73%; PPV of 12% and NPV of 99%. No uterine dehiscence was observed with LUS thickness of >4.5 mm.[18] Rosenberg et al observed sensitivity of 88%, specificity of 73.2%, PPV of 11.8% and NPV of 93.3 with a cut off of 3.5 mm.[16] Gotoh et al recorded intrapartum incomplete uterine rupture in 17 out of 23 women (74%) with LUS scar thickness less than 2.0 mm.[19] In the study done by Salvatore et al using a cut-off 0f 3.0 mm for LUS scar thickness, sensitivity of 100%; specificity of 85%, PPV of 45% and NPV of 100% were observed.[20] Asakura et al concluded that an appropriate cut-off value for achieving a successful VBAC is 1.6 mm.[17] Lower values would predispose to complication of uterine defect. Myometrial thickness was used; hence it was a drawback in their study. Measuring only the myometrial thickness is more technically difficult than measuring the whole LUS thickness and it does not add anything to the PPV for uterine rupture or scar dehiscence in patients with LUS scar thickness of more than 3.0 mm. Thus, its evaluation may be useful in estimating the risk of uterine scar dehiscence or rupture if the LUS scar thickness is near the cut-off value (3.5±0.2 mm).

In patients who had a LUS scar thickness greater than the proposed cut-off value, it is probable that the myometrial thickness is good enough to avoid dehiscence and therefore measuring the myometrial thickness does not provide any additional information. The full LUS scar thickness measurement was used in our study. Not more than three radiologists did the assessment for increased strength of accuracy. The positive predictive value of the ultrasound measurement was weak in this study as well as studies from other literatures cited. This suggests that all thin lower uterine segment scars are not abnormal. The ultrasound scan measurement has a good negative predictive value confirming that a thick lower uterine segment is usually strong. Since the negative prediction can be obtained at 36 weeks' GA, the result of this examination can easily be included in factors to consider for successful VBAC.

Limitations

Current study was limited by the fact that it was a hospital-based study of which the result may not reflect the findings in the generality of tertiary institutions in the country, Africa or other continents. Some decisions for emergency CS may have also been taken prematurely to avoid more severe foeto-maternal outcome. Perhaps, the VBAC rate of 66.9% would have been more.

CONCLUSION

Transvaginal ultrasonographic lower uterine segment scar thickness measurement is an important assessment for predicting possibility of achieving a successful VBAC as a primary outcome or the likelihood of recourse to abdominal delivery with or without unfavourable outcome. There are numerous factors that can be associated with successful VBAC and not just the clinical variables alone. This research has clearly shown that full LUS scar thickness of ≥3.5 mm at 36 weeks of gestation is associated with an increased chance of successful VBAC while LUS scar thickness of <3.5 mm is at increased risk of uterine rupture and uterine scar dehiscence during a trial of VBAC. The high negative predictive value for prediction of uterine dehiscence in this study will encourage obstetricians to offer trial of VBAC to women who have met the selection criteria and meet the LUS scar thickness cut-off ≥3.5 mm. This will improve successful VBAC rate.

Recommendations

We recommend that the Lower uterine segment scar thickness assessment at 36 weeks' GA be included in the factors for trial of VBAC while still embarking on more studies (larger, multi-centred and well designed). Cut-off point of 3.5 mm full LUS scar thickness should be adopted and should be prospectively validated in future studies.

ACKNOWLEDGMENTS

Authors would like to thank all the patients and staff of all the health facilities used for this study for all the roles they played in making this research successful.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Ikoro C, Omietimi JE, Kiridi EK, Fumudoh B, Aigere EOS, Oriji PC, et al. Lower uterine segment scar thickness as a predictor of successful vaginal birth after caesarean section at the Federal Medical Centre, Yenagoa: a prospective cohort study. Int J Reprod Contracept Obstet Gynecol 2023;12:44-51