Assessment of Cesarean hysterotomy scar before pregnancy and at 11-14 weeks of gestation: a prospective cohort study

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Abstract

Objective *To compare the appearance and measurement of Cesarean hysterotomy scars in non-pregnant women and in a subsequent pregnancy at 11-14 weeks.*

Methods *In a prospective cohort study we included women aged 18-35 years with one previous Cesarean delivery (CD) performed at ≥37 gestational weeks. Women were examined with saline contrast sonohysterography 6-9 months after CD. A scar defect was defined as large if the scar thickness (ST) was ≤2.5 mm. Women were followed up and those who became pregnant were examined with transvaginal ultrasound at 11-14 weeks. ST measurements were taken, and scars were subjectively classified as scar with large defect or no large defect. A receiver-operating characteristics curve was drawn to determine the best cut-off value for ST, which can predict scar with large defect at the 11-14 weeks scan.*

Results *A total of 111 women were scanned in the non-pregnant state and at 11-14 weeks. The best cut-off value for ST to predict a scar with large defect at 11-14 weeks was 2.85 mm. This cut-off value had 90% sensitivity (18/20), 97% specificity (88/91) and 95% accuracy (106/111). In the non-pregnant state*

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large scar defects were found in 18 (16%) women, and all were confirmed at the 11-14 weeks scan. In addition, large defects were found in 3 women, who did not have large defects in the non-pregnant state.

Conclusion *Cesarean hysterotomy scar appearance was quite similar in the non-pregnant state and in a subsequent pregnancy at 11-14 weeks.*

KEYWORDS: Cesarean delivery, scar defect, saline contrast sonohysterography, ultrasonography, non-pregnant women, 11-14 weeks scan

INTRODUCTION

During recent years there has been a marked increase in the rate of Cesarean delivery (CD)[1]. In 2010 the CD rate was 33% in US and 25% in Europe[2, 3]. It has been suggested that the CD rate in US may reach 56% in 2020[4].

Women with previous CD have higher risk of complications in a subsequent pregnancy and during delivery, such as placenta previa, placenta accreta and uterine rupture[5-7]. Sonography has been used to study the possible association between the appearance of Cesarean hysterotomy scar and scar integrity during labor[8-12]. However, most ultrasound studies have been done in the late third trimester, and the results suggest that the degree of lower uterine segment thinning is a strong predictor of uterine scar defect at birth[12].

A Swedish study among non-pregnant women found a possible association between large defects of Cesarean hysterotomy scars at transvaginal sonography 6-9 months after CD and uterine rupture or dehiscence in a subsequent pregnancy[8]. However, women are usually not planning their next pregnancy and delivery 6-9 months postpartum. Counselling on mode of delivery after one previous CD become important early in a subsequent pregnancy. Thus, we aimed to study if Cesarean hysterotomy scars change considerably from the non-pregnant state to the first trimester in a subsequent pregnancy. In the available literature (search in PubMed using keywords “cesarean”, “uterine scar”, “ultrasonography”) we found no previous studies comparing scar appearance in non-pregnant state and subsequent pregnancy.

The aim of the present study was to compare the sonographic appearance and measurement of Cesarean hysterotomy scar at saline contrast sonohysterography (SCSH) in non-pregnant women and at transvaginal ultrasound without contrast at 11-14 weeks in a subsequent pregnancy.

METHODS

This prospective cohort study was carried out at Skåne University Hospital (Sweden) and was approved by the institutional ethics committee (2013/176). Informed written consent was obtained from all participants after the procedures had been fully explained to them.

We recruited women aged 18-35 years who had one previous CD performed at ≥37 gestational weeks with no previous uterine surgery other than CD (conization, loop electrosurgical excision procedure, curettage were allowed). Women with two or more previous CD or a previous CD other than a low transverse hysterotomy were excluded.

The electronic patient record system at Skåne University Hospital was prospectively searched every month to identify eligible women with CD from March 13th 2013 to May 31st 2015. An invitation to participate in the study was sent to all eligible women and those who accepted, were prospectively booked for an ultrasound examination 6-9 months after their CD.

Immediately before the examination a pregnancy test (urine hCG) was taken and a patient history recorded. The patient history was obtained following a standardized research protocol with information on parity, day of menstrual cycle if resumed, breast feeding, contraceptives, earlier deliveries and gynecological operations.

SCSH was performed with empty urinary bladder and the woman in the lithotomy position[13]. No premedication or prophylactic antibiotics were given before the examination. To assess the tolerance of the procedure all women were asked if they had discomfort during or shortly after SCSH. Women were

instructed to contact the research team in case of complications such as pain or infection within one week after SCSH.

Uterus was scrutinized in a sagittal plane, and the presence of a scar was noted. Any indentation in the scar, however small, was classified as a defect. Scars were classified into two categories: scar with large defect or no large defect. According to previously published data, a defect was defined as large if the thickness of myometrium in the thinnest part of the scar area, scar thickness (ST), was ≤2.5 mm[13].

Women were asked to contact the research team when they become pregnant. In addition, the electronic patient record system of the hospital was searched once a month to check for new pregnancies among the recruited women.

Pregnant women were invited back for a new examination with transvaginal ultrasound with emptied urinary bladder between 11+0 and 13+6 weeks of pregnancy, as determined by crown-rump length measurements taken during the examination. The uterine scar was identified with similar technique used for examination in non-pregnant women. Scars were subjectively classified into two categories: scar with large defect or no large defect. Subjective evaluation was used to establish cut-off value for ST measurement for the detection of large scar defects at the 11-14 weeks scan.

All ultrasound examinations were performed with GE Voluson 730 or GE Voluson E8 expert ultrasound systems (General Electric, Zipf, Austria) equipped with transvaginal probe RIC 5-9H or RIC 5-9-D, respectively. All scans were done by the same operator. Ultrasound images were evaluated and measurements were taken immediately after the examinations. At the 11-14 weeks scan the operator was blinded to the results of the first examination. All representative images were stored on a digital image storage system (Siemens Syngo Dynamics, version VA10B, Siemens Medical Solutions Health Services, USA, Inc.).

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 22 (SPSS Inc., Chicago, IL, USA).

Comparisons of ultrasound measurements taken in non-pregnant women and at the 11-14 weeks scan were analyzed by the Wilcoxon signed rank test. Paired dichotomous categorical variables were compared by McNemar's test. $P < 0.05$ was considered statistically significant.

We used receiver-operating characteristics (ROC) curves to establish cut-off values for ST for the classification of scars with large defects at the 11-14 weeks scan. The point located farthest from the reference line was selected as the best cut-off value.

RESULTS

Flow chart of study participants is presented in Figure 1. SCSH was accepted and tolerated by all women, and there were no complications of the examinations.

One hundred fifty nine pregnancies occurred among 535 recruited women followed up over a period of 1 to 25 months after examination in non-pregnant state.

One hundred eleven women were examined at 11-14 weeks. Median gestational age at examination was 12+2 weeks (interquartile range (IR) 11+4 – 13+1 weeks). Median time from previous CD to new pregnancy was 16 months (IR 11-22 months). Among 111 women scanned at 11-14 weeks, 48 (43%) women had already restored their regular menstrual cycle at the time of the non-pregnant scan. Cesarean hysterotomy scars were visualised in all women at all examinations.

Summarized characteristics of study participants are shown in Table 1.

Median ST measurement at the 11-14 weeks scan (n=111) was 6.1 mm (IR 3.8 - 8.6). At non-pregnant scan median ST measurement in this group of women (n=111) was 6.1 mm (IR 3.7 - 8.0). Median difference in paired ST measurements between scans at 11-14 weeks and the non-pregnant state was 0.1 mm (IR -0.7 – 1.6) ($p = 0.09$).

The ROC curve for ST measurements at 11-14 weeks to predict large scar defects is presented in Figure 3. Area under the curve was 0.98 (95% confidence interval 0.95-1.0). The best cut-off for ST

measurement to predict scar with large defect was 2.85 mm. This cut-off had 90% sensitivity (18/20), 97% specificity (88/91) and 95% accuracy (106/111).

Agreement between SCSH and scan at 11-14 weeks to detect scars with large defects is presented in Table 2. The agreement was high (108 of 111 women). In the non-pregnant state large scar defects were found in 18 (16%) women, and all of them were confirmed at the 11-14 weeks scan. In addition, large defects were found in 3 women, who did not have large defects in the non-pregnant state.

DISCUSSION

We found that Cesarean hysterotomy scar appearance was quite similar in the non-pregnant state and in a subsequent pregnancy at 11-14 weeks. All large defects in the non-pregnant state were confirmed at the 11-14 weeks scan and in addition 3 women with large defects were found.

The observed minor differences in scar appearance between non-pregnant state and 11-14 weeks may be explained by several factors. Theoretically, changes of the endometrium in the non-pregnant state could influence the appearance of the scar at ultrasound examination because the endometrium depends on the day of menstrual cycle and the use of contraceptive pills[14]. Also, at 11-14 weeks the increasing intrauterine pressure due to developing pregnancy and/or pregnancy related histological changes in the myometrium may influence scar appearance. However, it is unlikely that ST measurements will be influenced by these factors[15].

All women were examined in non-pregnant state at 6 months or later after their previous CD. It has been shown that the prevalence of a 'niche' in a Cesarean hysterotomy scar was similar between groups of women examined at 3-12 months, 1-5 years or 5-10 years after CD[16]. Thus, we believe that a change in the appearance of a Cesarean hysterotomy scar after a non-pregnant scan due to incomplete healing is unlikely, and that different time intervals from the CD to the subsequent pregnancy is unlikely to have biased the results.

One strength of the study is the prospective study design and that a large proportion of eligible women were included. In addition, all ultrasound examinations were performed by the same experienced operator with focus on the evaluation of Cesarean hysterotomy scars. Scans were done according to standardized procedures[13, 17].

One limitation of the present study is that we did not relate ultrasound findings to pregnancy outcomes. Although there is some evidence which suggest likely association between large defects of Cesarean hysterotomy scar in non-pregnant state and scar integrity at subsequent delivery[8], larger prospective studies are necessary. Such studies will require large number of participants since uterine rupture is a rare event and uterine dehiscence can only be diagnosed during operative delivery. In a previous study it was estimated that in order to identify 20 cases of uterine rupture or dehiscence, at least 800 non-pregnant women should be recruited and followed up for four years[8].

Potentially, non-pregnant scans may be used in pre-conception counselling of women who consider more pregnancies after CD. Scanning the non-pregnant women give some support at an early stage and reassurance to women who consider vaginal birth in a subsequent pregnancy. However, a scan at 11-14 weeks in the pregnant woman may be a better approach. One need not scan women, who will not become pregnant, and the timing (11-14 weeks) is perfect for planning the delivery. In addition, the 11-14 weeks scan have become routine in many countries to confirm viability of the fetus, date the pregnancy, assess multiple pregnancies, detect fetal anomalies and assess the risk of aneuploidy[18]. Greco et al. suggested that cervical length measurement at 11-14 weeks combined with maternal characteristics may predict spontaneous preterm delivery with estimated detection rate of 54.8% and false-positive rate 10%[19]. O'Gorman showed that combined screening which includes uterine artery pulsatility index measured at 11-14 weeks may predict 75% of cases of preterm-preeclampsia and 47% of cases of term-preeclampsia at a false-positive rate of 10%[20]. In patients with previous CD, Stirnemann et al. suggested that the scan at 11-14 weeks can help to stratify risk for placenta accreta and set up follow-up plan for high-risk patients[21].

In conclusion, Cesarean hysterotomy scar appearance was quite similar in the non-pregnant state and in a subsequent pregnancy at 11-14 weeks. Our findings should not lead to any changes in clinical

practice. Our results justify the performance of an appropriately powered prospective study to determine association between large defects of Cesarean hysterotomy scar and uterine rupture or dehiscence at subsequent delivery.

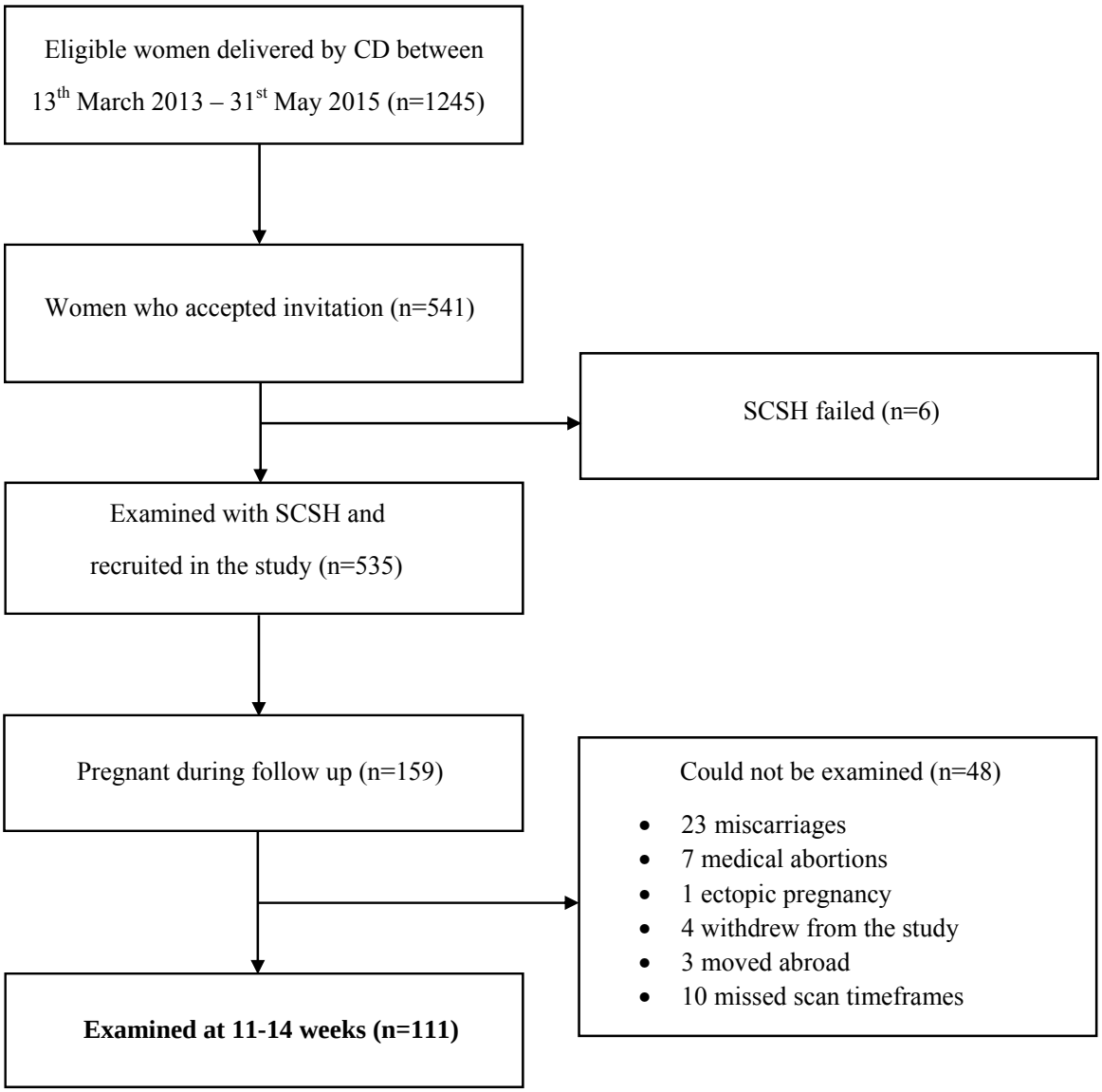

Figure 1 Flow chart describing number of women included in the study and the selection of the study group

(a)

(b)

Figure 2 Ultrasound images of large scar defect obtained from the same woman in non-pregnant state at SCSH (a) and at the 11-14 weeks scan (b)

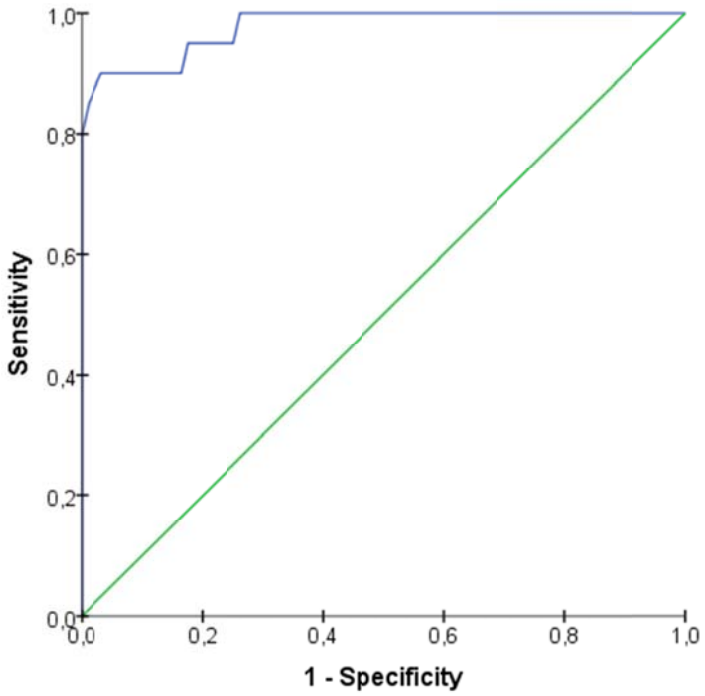

Figure 3 Receiver-operator characteristic (ROC) curve for the scar thickness over the defect

Table 1 Characteristics of women examined in non-pregnant state and in the first trimester

Characteristic	Women examined in non-pregnant state (n=535)	Women examined at 11-14 weeks scan (n=111)
Maternal age at examination in non-pregnant state, years, median (IR)	31 (28 – 33)	31 (27 – 33)
Parity, % (n) 1 2 3 4	 80.7 (432) 17.2 (92) 1.7 (9) 0.4 (2)	 92.8 (103) 6.3 (7) 0.9 (1) 0 (0)
CD, % (n) Emergency Planned	 58.7 (314) 41.3 (221)	 65.8 (73) 34.2 (38)
Gestational age at previous CD, weeks, median (IR)	39 (38 – 41)	39 (38 – 41)

IR, interquartile range

Table 2 Agreement between SCSH in non-pregnant state and at the 11-14 weeks scan with regard to detection of scar with a large defect

	Large defect at 11-14 weeks scan*		Agreement (% (n))	p-value†
	No	Yes		
Large defect at SCSH*				
No	90	3	97 (108/111)	0.250
Yes	0	18		

* According to objective classification, using ST cut-off values of 2.5 and 2.85 mm, respective for SCSH and 11-14 weeks scan

† McNemar's test

SCSH, saline contrast sonohysterography

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