

Submitted:
13.11.2017
Accepted:
16.04.2018
Published:
29.06.2018

Ultrasonographic criteria of cesarean scar defect evaluation

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DOI: 10.15557/JoU.2018.0024

Keywords

scars,
caesarean section,
ultrasound imaging

Abstract

Cesarean sections account for approximately 20% of all deliveries worldwide. In Poland, the percentage of women delivering by cesarean section amounts to over 43%. According to studies, the prevalence of cesarean scar defects ranges from 24–70%. Due to the overall cesarean section rate, this is a medical problem affecting a large population of women. In such cases, ultrasonographic evaluation of a cesarean scar reveals a hypoechoic space filled with postmenstrual blood, representing a myometrial tear at the wound site. Such an ultrasound appearance is referred to as a niche, and it forms after a cesarean section at the site of the hysterotomy of the anterior uterine wall, most commonly within the uterine isthmus. Currently, the exact cause of niche formation remains unexplained, yet the risk factors for its development are universally acknowledged. They include the site of hysterotomy, multiple previous cesarean section deliveries, suturing technique and maternal diabetes or smoking. Ultrasound evaluation of the cesarean section scar is an important element of obstetric and gynecologic practice, especially in the case of further pregnancies. It facilitates an early diagnosis of a cesarean scar ectopic pregnancy, and the prediction of the risk for perinatal dehiscence in the case of a vaginal birth after a cesarean section.

Introduction

Currently, approximately 20% of births worldwide happen to be cesarean section (CS) deliveries, accounting for approximately 1.5 million CS procedures performed annually. In Poland, the CS rate amounts to over 43% of all deliveries. In a routine ultrasound evaluation of a non-pregnant uterus in a randomly selected population of women with a history of at least one CS, the prevalence of CS scar defects ranges from 24–70%. Due to the total number of CS and the prevalence of CS scar defects, this is a medical problem affecting a large population of women⁽¹⁾.

Ultrasonographic appearance of a SC scar niche

The best timing for an US evaluation is immediately after menstruation, when the endometrium is the thinnest. During the exam, a hypoechoic space filled with postmenstrual blood is visible, most typically triangular in shape, reflecting a discontinuation of the myometrium at the site of the previous CS^(1,2). Such a finding is known as a niche, even though “a cesarean-induced isthmocoele” is another term employed in the current literature of the subject. A niche is defined as a myometrial defect with a depth of at least 2 mm. A large niche is defined as an incision of a depth of at least 50 or 80% of the anterior myometrium, or the remaining myometrial thickness ≤ 2.2 mm when evaluated by TVS and ≤ 2.5 mm when evaluated by sonohysterography⁽²⁾.

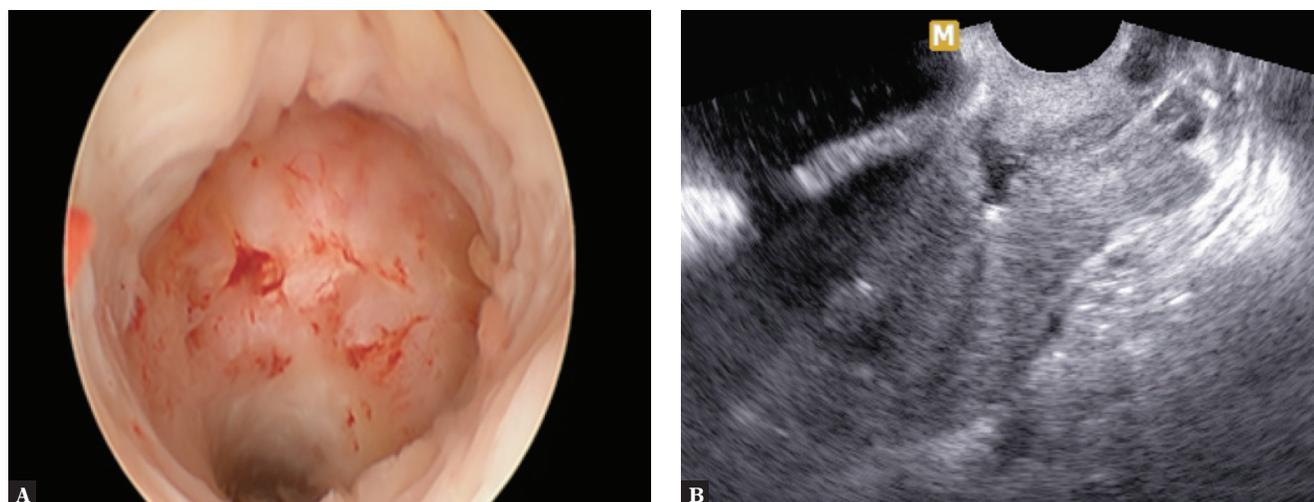


Fig. 1. A. A CS scar defect visible in a hysteroscopic evaluation. B. CS scar defect (niche) visible in a US evaluation

A niche forms after CS at the site of hysterotomy of the anterior uterine wall. It is most commonly located in the uterine isthmus, yet it may also be found within the cervical canal or uterine body.

Currently, the exact causes of niche formation remain unresolved, yet the risks factors for its development are well known. The key factors include the site of hysterotomy, number of previous CS, suturing technique, and maternal conditions such as diabetes or smoking. A lower segment CS, also known as low or cervical hysterotomy, increases the chance of niche development. The use of appropriate suturing technique is crucial, as suturing all uterine wall layers with a single suture or the use of locked sutures is not sufficient, increasing the risk for an indentation, or a fluid-collecting niche, forming at the wound site. Diabetes and smoking adversely impact any healing process in the body, significantly delaying full recovery⁽²⁾.

The presence of a niche is associated with a significant risk for serious sequelae. It collects menstrual blood, resulting with abnormal peri-menstrual bleeding or spotting. It also causes pelvic pain, painful menstruation and dyspareunia. The accumulation of blood in this area may also negatively affect the quality of cervical mucus and semen, as well as interfere with semen transport, leading to suboptimal fertility, including complete inability to conceive. The indentation visible on a US scan weakens the developing scar. A serious sequelae may be the implantation of an embryo within the niche, i.e. development of an cesarean scar ectopic pregnancy (CSEP). In such cases, an empty uterine cavity and cervical canal will be visualized on a US scan, with the embryo embedded within the anterior wall of the uterine isthmus, and a complete lack of or a very thin endometrial stripe between the bladder and the gestational sac (GS). A Doppler evaluation will visualize marked vascular flow surrounding the gestational sack and high-velocity, low-impedance trophoblastic flow⁽²⁻⁴⁾.

The differential diagnosis for CSEP must include spontaneous miscarriage, missed miscarriage and cervical EP. The diagnosis of a CSEP is invariably challenging, as approximately 30% of patients may not present with any symptoms, and in 70% the symptoms mimic EP. TVS is the most accurate differential test, with a sensitivity of 84.6%. Additionally, saline infusion sonohysterography, MR, 3D US and hysteroscopy may also be helpful⁽⁵⁾ (Fig. 1).

An inadequately healed CS scar may also complicate an otherwise healthy pregnancy. Physiologically, the placenta is attached to the endometrial layer known as Nitbauch's layer, i.e. the layer of fibrin separating the decidua basalis and the trophoblastic tissue. However, at the site of a poorly healed CS wound, the endometrium is much thinner than normal, allowing the placenta to attach to deeper layers of the uterine wall, resulting with various degrees of myometrial invasion. Depending on this degree, three grades of abnormal placental attachment are defined: placenta accreta, where chorionic villi attach to the myometrium, but without penetrating it, placenta increta where chorionic villi penetrate the myometrium, and placenta percreta, where chorionic villi invade through the perimetrium, or even reach the peritoneum and the adjacent organs, such as the bladder⁽⁶⁾.

Discussion

In light of the scale of the possible sequelae associated with a CS scar defect, its adequate diagnosis and appropriate prevention become of paramount importance. A randomized study covering 30 women by Hamar *et al.* showed no statistically significant correlation between the suturing method and the prevalence of dehiscence. However, in that study, the CS scar was followed up on TVS at 48 hours, 2 and 6 weeks after surgery⁽⁷⁾. A study by Hayakawa *et al.*, in turn, which covered a total of 137 women, demonstrated that double-layer interrupted suture reduced the prevalence of a myometrial defect after CS at 30–38 days after surgery⁽⁸⁾. Another randomized

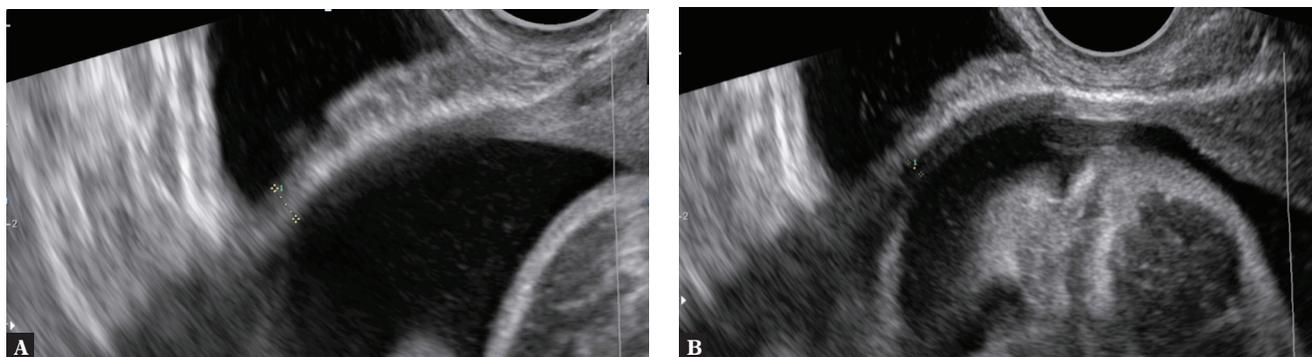


Fig. 2. A. Measurement technique for LUS thickness. B. Measurement technique for ML thickness

study, which covered 78 women in whom scar thickness was evaluated in TVS at 40–42 days after surgery, found that suturing all myometrial layers, including the endometrium, reduced the risk for inadequate healing and incomplete regeneration⁽⁹⁾. Finally, a retrospective study by Sevket *et al.* applying the longest follow-up period, of 6 months, showed that the use of a double layer locked/unlocked suture after CS promoted complete healing, increasing the thickness of the lower segment of the uterus. The thickness of the residual myometrium measured in TVS was 9.95 ± 1.94 mm after a double-layer closure vs. 7.53 ± 2.54 mm after a single-layer closure⁽¹⁰⁾. Hence, the studies discussed above confirm that the right closure technique allows to prevent niche development, strengthen the sutured uterine wall, and reduce the recovery time.

Over the recent years, the prevalence of VBACs has been on the rise. Perinatal dehiscence after a previous CS poses a serious risk for the life and health of both the mother and the fetus. According to the literature of the subject, the rupture of a CS scar is a relatively rare occurrence, estimated at 12: 10 000 deliveries for elective CS, and at 35: 10 000 for vaginal births⁽¹¹⁾. Inevitably, every pregnant woman with a history of CS has concerns about CS scar's stability. The proper strategy for US evaluation of CS scar prior to a planned vaginal birth is essential.

In their study, Ofili-Yebovi *et al.* found that a policy of routine scar assessment by US in non-pregnant women to prevent uterine rupture during future labor is unlikely to be helpful in obstetric practice. The scar's thickness did not correlate with the number of cases of scar rupture, whilst the risk increased with multiple CS and uterine retroflexion. The authors concluded, nonetheless, that a small number of women with a history of multiple previous CS may benefit from an early scan at

6–7 weeks of pregnancy, aimed at the identification and treatment of CSEP⁽¹²⁾.

Jastrow *et al.*, in turn, analyzed 20 studies assessing CS scar thickness by US, covering a total of 1834 women. A perinatal CS defect was found in 121 pregnant women (6.6%). The authors performed a statistical analysis of the results regarding the thickness of the lower uterine segment (LUS), defined as the smallest measurement between the amniotic fluid and urine in maternal bladder. They also analyzed the myometrial thickness, or the myometrial layer (ML), described as the smallest hypoechogenic portion of LUS (Fig. 2). The optimal cut-off value in the evaluation of the risk for CS scar rupture ranged from 2.0 to 3.5 mm for full LUS thickness, and from 1.4 to 2.0 mm for ML. The authors stressed in their conclusions that LUS may be considered a strong prognostic factor for a CS scar defect in women considering a vaginal birth after a cesarean section (VBAC)⁽¹³⁾.

Conclusion

All the above considered, US assessment of a SC scar is a vital element of gynecologic and obstetric practice, particularly so in pregnant women. It allows for an early identification of a cesarean section scar ectopic pregnancy, and where a vaginal birth is considered, it facilitates the prediction of perinatal dehiscence.

Conflict of interests

The authors do not declare any financial or personal links to any persons or organizations that could adversely affect this publication or claim rights thereto.

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