Niche: A growing problem for gynecologists and obstetricians

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Abstract

Niche formation is a growing problem in Brazil and worldwide. Today, cesarean delivery rates far exceed levels recommended by the World Health Organization. The procedure constitutes the most common surgery in the world, and its most frequent complication is niche formation (84% prevalence), as detected by sonohysterography. Several gynecological problems related to this cesarean scar defect can ensue, with the most frequent symptom being abnormal uterine bleeding. Obstetric problems in subsequent pregnancies include uterine rupture, abnormal placentation, and cesarean scar pregnancy. Recommended treatments yield good results, but there is no consensus on niche prevention, owing to incomplete understanding of its pathophysiology. Comparisons of surgical techniques have revealed no significant

differences. Further studies are needed to elucidate the multifactorial pathophysiology of niche and help to develop approaches for preventing its occurrence.

Keywords: cesarean scar defect; isthmocele; niche; sonohysterography; abnormal uterine bleeding

1. Introduction

Niche, also referred to as isthmocele, wedge, or pouch, is a healing defect in the uterus after a cesarean section. As vaginal delivery rates have decreased, niche has become a growing problem.[1] Gynecologists and obstetricians should therefore be aware of the relationship between this defect and a range of gynecological and obstetric complications in subsequent pregnancies,[2,3] and hold knowledge on how to treat these events.[4]

Consensus on the definition of niche is lacking. Bij De Vaate et al.[5] define niche as a space located in the anterior myometrial wall at the site of a previous triangular-shaped cesarean section hysterotomy, the apex of which is focused on the serosa, which results from a healing defect in the operative wound. Quantitative criteria include a depth of at least 1 mm and myometrial indentation at least 2 mm deep.

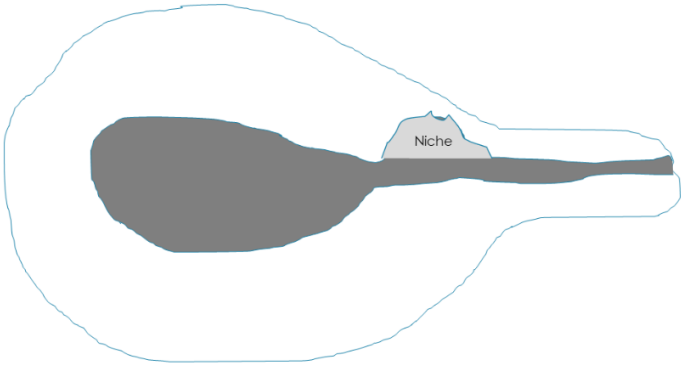

Figure 1. Niche location on the anterior uterine wall.

Abnormal uterine bleeding,[6] chronic pelvic pain, dyspareunia, dysmenorrhea, and infertility[7,8,9] are the principal long-term gynecological consequences. In subsequent pregnancies, different, and potentially catastrophic, manifestations of the same process[10] may present, including placental accretism, abnormal placentation, hemorrhage at delivery, cesarean scar dehiscence, and cesarean scar pregnancy. Although the overall incidence of uterine rupture is 5.3 per 10,000 deliveries, the complication affects roughly 1% of women with a history of cesarean section.[11] This increased risk directly influences the joint decision made by obstetrician and pregnant woman on whether to conduct a trial of labor in the subsequent pregnancy.[12]

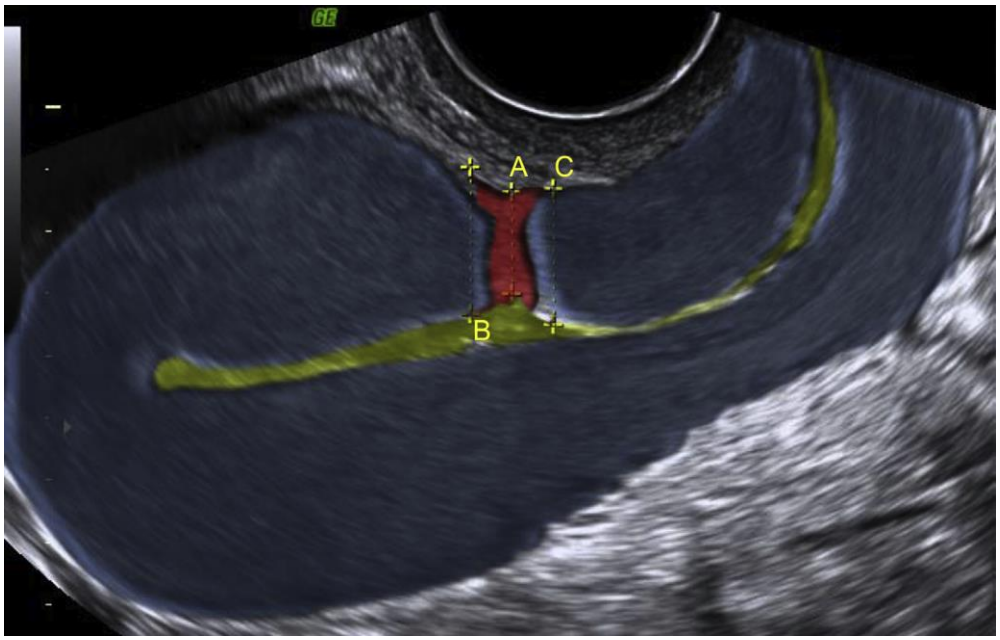

Figure 2. Sagittal uterine plane obtained by transvaginal ultrasound six weeks after cesarean section, showing thicknesses of cesarean section scar (A), proximal myometrium (B), and distal myometrium (C). Source: Dosedla et al. (2012).

2. Epidemiological Aspects

Niche formation is the most common complication after a cesarean delivery.[13] Its frequency depends on the definition adopted,[5] time elapsed after the cesarean procedure, the diagnostic method employed,[1,8] and number of previous cesarean sections.[14]

Tulandi and Cohen[8] found prevalence ranges of 24-70% by transvaginal ultrasound and 56-84% by sonohysterography. Osser et al.[14] found niche prevalence to increase with the number of cesarean sections: 61% for women with one cesarean delivery, 81% for those with two sections, and 100% for those with three or more C-sections.

Niche is considered a large defect when accounting for at least 50-80% of myometrial thickness or leaving a residual myometrium of 2.2 mm on transvaginal ultrasound or of 2.5 mm on sonohysterography. The reported prevalence of large defects among niche patients ranges from 11%[8] to 50%.[26] In a study involving 1856 patients, all cases of uterine dehiscence in repeated cesarean sections occurred in women with a lower uterine segment smaller than 3 mm on ultrasound examination performed at between 34 and 38 weeks.[15] In an attempt to predict the risk of uterine rupture, Seliger et al.[16] described good results for an association of transabdominal and transvaginal ultrasound performed on the day of delivery.[16]

3. Diagnosis

Niche formation can be suspected in women presenting with gynecological complaints and a history of cesarean section, especially if accompanied by abnormal uterine bleeding, the most frequent symptom. An association of myometrial retraction and thickness discrepancy between upper and lower margins is the hypothetical mechanism,[4] resulting in poor contractility of the uterine muscles around the niche and leading

to menstrual blood retention on its topography.[5]

Transvaginal ultrasound has proven an accurate diagnostic method, superior to transabdominal ultrasound in the sixth week postpartum,[3] yielding a 100% correlation with hysteroscopy, which is considered the gold standard.[17] Sonohysterography with saline solution or gel has shown noteworthy advantages, such as better sensitivity and specificity, in addition to deeper, larger niche measuring[18,19,10,20,4] than transvaginal ultrasound.[8] Optimal timing of transvaginal ultrasound is during a bleeding episode and a few days after menstruation.[17]

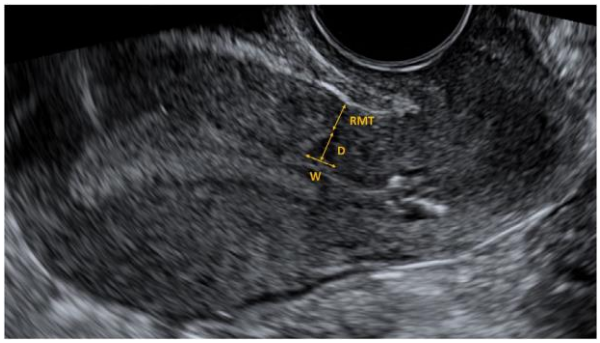

Figure 3. Measurement of standardized cesarean section scar in a non-pregnant uterus. RMT: residual myometrial thickness; D: scar niche depth; W: scar niche width. Source: Pomeranian et al. (2016).

Adding to reports of innovative evaluation techniques, Bolten et al.[3] performed image fusion between transvaginal ultrasound and magnetic resonance imaging with evaluation of vascularization in the region. Bazzo et al.,[21] comparing anterior and posterior isthmus thicknesses, found the latter to be twice that of the former. Overall, these measures decrease with age, but the ratio between anterior and posterior wall thicknesses remains similar across all age groups. This ratio therefore might provide better quantification of a reduction in myometrial scar height.

The dehiscence risk coefficient (RDC) expresses the ratio between scar thickness (s) and thickness of the myometrium adjacent to the defect (average between mean proximal (p_m) and mean distal (d_m) scar thicknesses), as follows: $RDC = s / (p_m + d_m) \times 0{,}50$.[48] Dosedla and Calda[22] found no differences in this coefficient between late puerperium (six weeks) and six months postpartum.[22]

4. Predisposing Factors

The risk of niche formation is not influenced by multiparity as much as by a history of cesarean sections,[18] especially when these are multiple[23] and involve previous niche diagnosis.[24] The risk is compounded when the interval between cesarean procedures is shorter than 18 months or exceeds 54-60 months[46] and when delivery is performed before the 37th week of pregnancy.[25]

In cesarean sections performed before labor, the absence of cervical dilation precludes effective drainage of the uterine cavity,[24] demanding more vigorous uterine activity and resulting in thickening of the posterior uterine wall and thinning at the incision site.[1]

Vervoort et al.[34] categorized the principal hypotheses for niche formation into four types:

▪ Hypothesis 1: Low location (*i.e.*, cervical) of the uterine incision during cesarean section. Zimmer[49] corroborates this hypothesis. Osser and Valentin,[30] having demonstrated that healing defects are located

lower in the uterus than are intact scars, drew attention to cases in which labor is longer than 5 h and cervical dilation exceeds 5 cm. Half of the women with large niches had cervical dilation of 8 cm, while 9% had a closed cervix.

▪ Hypothesis 2: Incomplete closure of the uterine wall. This is related to the method of uterine closure[13]—*e.g.*, unsutured deep layer of the myometrium, poor alignment of incision edges, and myometrial ischemia. Niche formation is most likely related to inadequate material, ischemia-inducing suture technique, and use of longer-absorption sutures.[4,6] Depending on labor duration and cervical dilation, a thinner lower myometrial segment may result,[25] probably less vascularized and predisposing to niche development.[5,26] Twin pregnancy and advanced pregnancy have also been related to hypothesis 2, owing to extension of the lower uterine segment and thinning of the myometrium layer.[23] Tulandi and Cohen[8] posited that anchoring of the first myometrial suture layer is the most detrimental factor for increased ischemia,[8] an observation that corroborates other studies.[27,28,29] Uterine retroversion is another major factor associated with poor healing,[5,8,24] posing twice the risk as for anteversion,[26] in addition to an increased likelihood of a larger niche.[24,30] A possible explanation for this phenomenon is that, in the retroverted uterus, the mechanical tension of the lower uterine segment can hinder blood perfusion and oxygenation of scar tissue, negatively affecting wound healing[26,30,31]. An originally anteverted uterus may change to retroverted after cesarean section, particularly if a niche is present.[32]

▪ Hypothesis 3: Surgical procedures that induce adhesion development, consequently inducing scar damage, owing to retraction forces in the uterine scar. Sholapurkar questioned whether closure of the visceral peritoneum can reduce niche incidence.[33]

▪ Hypothesis 4: Patient-related factors or diseases that impair wound healing.[34] Other predisposing factors include infection of the uterine wound, which retards healing; anemia, which limits the capacity of the operative wound to obtain nutrients to coalesce[24]; hematoma at the angle of the uterine incision, enabling blood to dissect the uterine wall and infiltrate into muscle tissue[31]; high body mass index; and gestational diabetes.[18]

5. Prevention

Naturally, primary prevention entails, performing vaginal delivery as opposed to cesarean section, but once the latter has been indicated, every effort should be made to reduce the likelihood of niche development—a tricky endeavor, since the pathophysiology of this defect remains unclear. Poor healing following a cesarean section is not simply a result of bad surgical technique, but probably of a combination of multiple predisposing factors, as previously reported.[1,35] This raises the question as to why niche does not develop in all women undergoing cesarean section.[4]

A meta-analysis[36] of studies on suturing techniques[5,8,23,34,35,37,38,40] highlighted the advantages of two-layer sutures, although most investigations reported similar results for one- and two-layer approaches in terms of incision integrity.[1,2,39,41,42,43,44]

Bennich et al.[45] found no significant differences in niche detection between abdominal ultrasound (detection of up to 82%) in the immediate postpartum period and saline sonohysterography (nearly 100%) five months later. A meta-analysis of nine randomized controlled clinical trials that included 3969 women

found no difference between single or double-layer closure of cesarean section incisions for the incidence of cesarean scar defects or dehiscence and uterine rupture in subsequent pregnancies.[39] Bamberg et al.[37] observed that the incidence of niche formation in cesarean scars and niche depth were independent of hysterotomy closure technique.[37]

It remains unclear whether the endometrial layer should be aggregated into the suture thickness. Although this approach may predispose to the rare complication of scar endometriosis, the inclusion of a thin layer might reduce the occurrence of abnormal uterine bleeding.[1,8]

6. Treatment

In a systematic review, Van der Voet et al.[46] noted that the studies evaluated were poor to moderate in terms of methodological quality, and thus unreliable for drawing solid conclusions. More evidence is therefore required before the practice of niche correction can be safely recommended.[46]

Uterine perforation and bladder injury are the most frequent complications of hysteroscopic treatment. Hysteroscopy is recommended when the residual myometrial thickness exceeds 3 mm and there are gynecological complaints.[9] If thickness is lower and the patient wishes to become pregnant[47] or has a gynecological complaint, laparoscopic repair is indicated and can be performed in conjunction with hysteroscopy.

6.1 Hysteroscopy

Hysteroscopy requires no hospitalization and can be performed under spinal block or general anesthesia. The bladder is filled with a methylene blue solution to identify possible injury. The cervix is dilated to Hegar 9 for insertion of the hysteroscope with resectoscope and resection loop.[7]

The surgical technique involves removing fibrotic tissue from the anterior edge of the lesion until a healthy muscle layer can be seen, facilitating drainage of menstrual flow. Healthy tissue appears as a flap under a triangular pouch. The bottom of the recess is treated by electrocauterization with a roller ball,[4] and any dilated blood vessels or polypoid structures can be removed to avoid formation of serosanguineous fluid.[42]

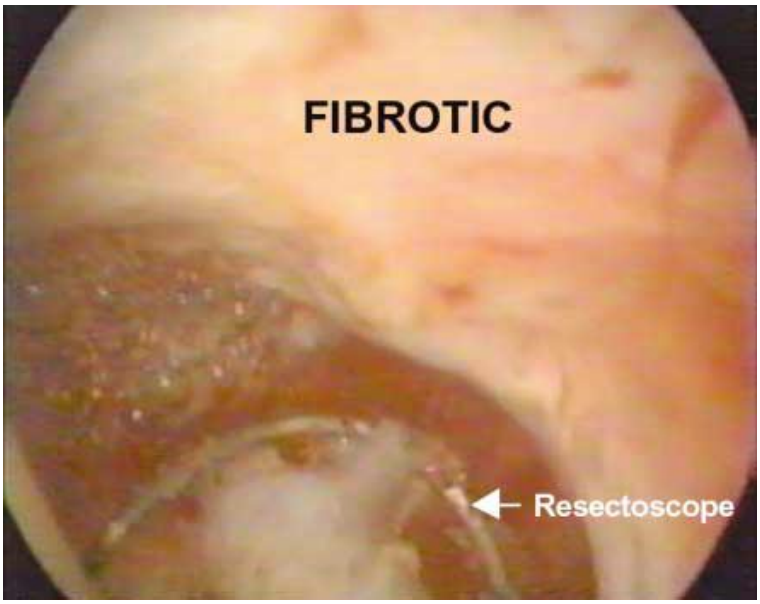

Figure 4. Hysteroscopic view of resection of overhanging fibrotic tissue beneath the pouch. Source: Fabres et al. (2003).

The distance between resection and bladder can be observed on transabdominal ultrasound. The procedure is safe, employing a maximum volume of 1000 mL of sorbitol or 2000 mL of NaCl. In the absence of complications, the patient can be discharged the same day.[7]

The informed consent form should address the possibility of isthmocervical incompetence and increased risk of uterine rupture in a subsequent pregnancy.[4]

6.2 Combined technique: laparoscopy and hysteroscopy

Hysteroscopic transillumination facilitates the location and evaluation of lesion size through laparoscopy. A bladder flap is performed, displaced downward from the bladder, and the margins of the defect are resected until healthy myometrial tissue is exposed. The edges are then rejoined in two or three layers with 2-0 polyglactin thread. The quality of the suture is deemed acceptable when no hysteroscopic fluid flows through the incision.

The combined technique has the advantage of promoting adesiolysis on the topography of the cesarean incision and correction of uterine retroversion. It also allows other conditions, such as endometriosis, to be investigated. Correction by laparoscopy is followed by a final hysteroscopy-assisted evaluation before the procedure is concluded.[9]

6.3 Vaginal correction

Few reports are available on cases requiring a vaginal approach. In such cases, the bladder is dissected from the cervix and the lesion is identified and resected. The results are similar to those obtained using the endoscopic technique.[9]

6.4 Hysterectomy

Hysterectomy is required in exceptional cases, being performed for large niches in women with no desire to get pregnant and in whom minimally invasive techniques cannot be employed.

7. Conclusion

Niche formation probably stems from multiple factors. The growing prevalence of this condition promoted by high cesarean rates makes this defect increasingly relevant. The first difficulty in investigating this pathology lies in a lack of consensus on its definition and classification, as well as in the standardization of diagnostic methods. Despite effective advances in treatment approaches, knowledge on the pathophysiology of niche remains incomplete, hampering the development of strategies for the prevention of this condition.

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