CHAPTER 5

TECHNICAL ASPECTS OF THE LAPAROSCOPIC NICHE RESECTION, A STEP-BY-STEP TUTORIAL

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ABSTRACT

The technique of a laparoscopic niche resection is described in ten steps and alternative steps for future studies are discussed. We should still only perform this intervention in research settings.
BACKGROUND

With rising percentages of caesarean sections, a great interest has risen for the long term morbidity. A niche can be observed with sonohysterography in approximately 60% of women 3-12 months after caesarean section (CS).\(^1,2\) Recently a clear relation between the presence of a niche and postmenstrual spotting has been reported in various studies.\(^1,2\) Other symptoms such as dysmenorrhea, chronic pelvic pain have been reported and a possible relation between a niche and subfertility has been postulated but remains to be proven.\(^3,6\) In some cases a large niche in combination with a strong retroflected uterus may reduce the accessibility of uterus causing problems during intra-uterine insemination or embryo transfer. Furthermore, a niche can cause obstetric complications such as niche pregnancies, malplacentation or uterine rupture.\(^7,11\) Given the associated symptomatology, various therapies have been developed recently.\(^12\) Hysteroscopic niche resection can be applied to reduce postmenstrual spotting with some days but does not restore the anatomy.\(^13,14\) In case of large niches and symptoms a laparoscopic niche repair can be considered. The number of publications reporting on this issue are limited, and most include case reports or small case series. According to the IDEAL criteria, the level of implementation can be classified to level 2a, thus the exploration phase.\(^15,16\) Its feasibility has been proven, and reported outcomes are promising, but structural follow-up was mostly missing and comparative studies are lacking. Only after completing the learning curve of a laparoscopic niche repair, a fair comparison can be made to other strategies, including expectant management. So far we performed more than 100 laparoscopic niche resections because of symptomatic and large niches in our hospital. We are still optimizing the technique based on our observations made during structural registration of our findings and structural follow-up in all women. The aim of the current paper is to share these findings to open the discussion on various technical aspects in order to improve the technique of this novel surgical procedure.

INDICATIONS

Not all niches need to be treated and a surgical intervention should only be considered in symptomatic niches in women that are willing to preserve their fertility. In women who do not want to conceive, hormonal treatment may be opted first and if this fails other surgical interventions including a vaginal or laparoscopic hysterectomy can be considered. In women with spotting symptoms and small niches with a RM $\geq 3$mm a hysteroscopic niche resection can be considered, but this will not restore anatomy. A laparoscopic niche resection can be considered in women with a large niche (RM<3mm) and gynaecological symptoms. Current literature provides insufficient evidence for a laparoscopic niche resection to improve reproductive outcome in asymptomatic women. Alternatively the method can also be applied in case of a niche pregnancy in a niche with a very thin RM that is not suitable for a curettage or if medical therapy such as local Methotrexate failed.\(^17\)
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THE TECHNICAL ASPECTS OF THE LAPAROSCOPIC NICHE RESECTION IN TEN STEPS

1 DIAGNOSTICS AND PREOPERATIVE EVALUATION

A niche can be observed using transvaginal sonography, sonohysterography or hysteroscopy. However, sonohysterography has been reported as the most optimal way to measure a niche including the residual myometrium.\(^1\)\(^,\)\(^2\)\(^,\)\(^18\) The latter is not possible during hysteroscopy. With transvaginal sonography, in the absence of fluid accumulation in the niche or uterine cavity, small niches can be missed but more relevant the residual myometrium may be overestimated.\(^1\)\(^,\)\(^2\) The introduction of saline or gel unfolds the niche inducing better delineation of the niche and flushes eventual cloths out of the niche.\(^18\) The residual myometrium should not only be measured in midsagittal plane, since the largest part of the niche, i.e. the thinnest part of the residual myometrium is often located at the lateral side of the uterus. Therefore it is essential to assess the uterus in sagittal plane from left to right and in transversal plane from fundal to cervix to identify the location where the niche has the largest diameter and the smallest residual myometrium. This strategy has also been proposed by the ‘The Niche Task Force of the European Society for Gynaecological Endoscopy’ after a Delphi method among experts on niche measurement. The results of this Delphi method will be published separately. Another relevant item to be assessed during niche measurement, in particular if surgical intervention is considered, is the location of the niche in the uterus. The level of the niche may affect the results of a laparoscopic niche resection. We experienced that niches in the lower part of the cervix may hamper proper suturing if the distance between the niche and the fornix of the vagina is limited. Additional we do not know if cervical tissue that contains mucus producing glands impair wound healing.\(^19\) Finally the relation of the niche with the uterine arteries can easily be assessed during ultrasound, it may be of help during the laparoscopic identification of the niche and its relation to the uterine arteries.
2 TROCAR PLACEMENT
Besides the umbilical trocar, we additionally add two side ports in the lower abdomen; 11 mm on the left and 5 mm on the right side. In order to obtain the optimal angle during suturing of the uterine wound, we place the lateral ports as low as possible. Additionally we place one port para-umbilical, the advantage of this position over the suprapubic midline is the improved ergonomy (Figure 1). Additionally it facilitates adhesiolysis between the corpus and abdominal wall. If existent, these adhesions hamper midline placement of an eventual suprapubic trocar anyway.

3 HYSTEROSCOPIC EVALUATION OF THE NICHE DURING THE PROCEDURE
A 5 mm hysteroscope is introduced by vaginoscopy for the evaluation of the niche, its location, branches and eventual numbers of niches. The exact location is important to determine the level and extension of adhesiolysis and bladder dissection. The deepest point of the niche in general illuminates the light of the hysteroscopy and can be visualised by laparoscopy after reducing the laparoscopic light (Figure 2). Finally, after closing the wound the end result can be measured and an eventual residual niche can be evaluated and registered.
Tips:
- a niche may resemble a uterine cavity, confirm the existence of the tubal ostia
- In case of very strong retroflected uteri, the visualisation of the endocervix may be improved by turning the viewing direction towards posterior.

4 BLADDER DISSECTION
Without exceptions adhesions are seen between the bladder and the niche (Figure 3). Filling the bladder with blue dye improves the recognition of the bladder. Due to the adhesions in the midline, opening the peritoneal fold can best be started at the lateral side with developing paravesical spaces. After dissecting the bladder form the posterior leave of the ligamentum latum the cervix can be reached and dissection of the midline from the bladder toward the fundal part of the uterus can be safely executed (Figure 4).
5 Adhesiolysis of dense adhesions between the on top of the niche

We often find dense fibrotic adhesions attached at the top of the niches in the majority of women (Figure 5). These adhesions are lysed using a cold scissor or after the application of monopolar current. Be aware of tenting in case of dense adhesions and do not start to low, otherwise this may cause unneeded injury of the serosa.

6 Identification and eventual dissection of the uterine arteries

The niche is often located at the level of the uterine arteries. In that case we advise dissection and clear identification of the uterine arteries before the resection of the niche. The latter will allow eventual safe coagulation if needed (Figure 6).
**7 UTEROTOMY AND RESECTION OF THE NICHE**

Illumination of the thinnest part by the hysteroscopic light allows recognition of the thinnest point of the niche. The light of the laparoscope can be reduced to have the most optimal view of the illuminated niche. The niche is opened at this thinnest point with the use of a monopolar hook and resected using a cold scissor, approaching from the lateral port. The niche is completely excised using a cold scissor. We aim to remove the thin part of the residual myometrium including all fibroitic tissue until the myometrium at both sides of the niche have a more or less similar thickness. This can be easily observed in case of a flexible scope (Figure 7). Alternatively, you may place a 30 degree scope into a lateral port or remove the hysteroscope and induce strong retroflexion of the proximal part of the uterus. We try to prevent extensive use of electrocoagulation in order to improve wound healing.

**8 DOUBLE LAYER FULL THICKNESS CLOSURING OF THE UTERUS WITH SINGLE SLIDING KNOTS**

The well vascularized myometrium is sutured in two layers (non-locking) approximating the full thickness, including the endometrium. We use multifilament resorbable sutures with a very strong half round needle (HR 26 SS or MO7). The ensure full thickness during suturing we enter the wound perpendicular and use the hysterscope as a reference (go over the scope before turning the needle). We continuously change our suturing hand in order to enable the optimal angle for needle placement: we place sutures to the distal part of the left side of the wound with our left hand and the proximal part with our right hand and reversed on the other side. The optimal angle can easier be achieved if the uterus is moved to the left and right by the intra-uterine hysteroscope. We do not knot the sutures before all sutures of the first layer are placed, otherwise we will not have sufficient space for proper needle placement (Figure 8). For this reason also the use of continues running (barbed) sutures are less optimal. To overcome the tension on the wound we use sliding knots. A second layer of sutures is used to reduce the tension on the wound. In case of sufficient distance between the distal part of the wound and the fornix anterior, we apply a double inverting suture, if the distance is limited we only apply a single u-shaped suture or some single knotted sutures.

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**Figure 7** Uterotomy and resection of the niche

**Figure 8** All sutures are placed first before knotting them
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9 SUSPENSION OF THE ROUND LIGAMENTS IN CASE OF (EXTREME) RETROFLECTED UTERI

An interesting observation is that most of the women with large symptomatic niches undergoing a laparoscopic niche resection have strongly retroflected uteri. We call them the “broken uterus”. The question rised which was first, a retroflected uterus which caused the scar to heal improperly or was the retroflection the result of the niche itself due to lack of support of the corpus by the incomplete closure of the uterine wall.\(^\text{19}\) For this reason, as an experimental intervention, we shorten the round ligaments in case of a strongly retroflected uterus. This procedure is also known as a Baldy anterior.\(^\text{20}\) We use absorbable multifilament sutures (Vycril 2.0) in order to position the uterus in a temporary anteverse position during the first weeks of wound healing to minimize counteracting forces on the wound (Figure 9). But it can be debated if this is helpful. Future studies are needed to confirm its use for this indication.

10 ADHESION BARRIER

Adhesion barrier (Hyaluronic acid) is placed at the uterine wound in order to reduce adhesion formation between the bladder, the abdominal wall and the uterus. We previously hypothesized that adhesion formation between the abdominal wall and the uterine scar was and the uterus may facilitate niche formation due to counteracting forces on the wound and as a consequence may reduce proper wound healing (Figure 10).\(^\text{19}\) The beneficial effect of this intervention requires future studies.

REGISTRATION OF THE APPLIED TECHNIQUES AND OF THE PERI-OPERATIVE FINDINGS AND OUTCOMES

We register women’s characteristics, symptoms, quality of life and ultrasound findings at baseline. During surgery we register our hysteroscopic and laparoscopic findings, surgeons experience (number of previous applied procedures) applied technique, hysteroscopic endresult, operating time and blood loss and eventual peri- and postoperative complications. At 3, 6 and 12 months follow-up we register both women’s reported outcomes and anatomical results between 3-6 months and at 12 months after the niche resection (Figure 11).\(^\text{13}\)

Figure 9  Suspension of the round ligaments

Figure 10  Applying adhesion barrier
**POSTOPERATIVE ADVICES**

We leave the urinary catheter in place for 6 hours in order to prevent urinary retention. Its need needs to be evaluated. Most women stayed one night in the hospital. In theory discharge on the same day is possible but most of the women were referred from other centers and had to travel for 1 or 2 hours and preferred admission for one night. We advise women to use contraception during the first 6 months. After this period they are allowed to conceive. In case of pregnancy we evaluate the lower uterine segment at 12, 20 and 30 weeks of pregnancy for research reasons. Independent of these findings we advise women to undergo an elective CS between 38 and 39 weeks of gestation. If the latter is really necessary in case of a thick residual myometrium warrants future research as well.

**DISCUSSION**

The technique described is a result of adjustments made during the last 8 years. We adjusted the technique along the years based on our observations made during our structured follow-up. As discussed above future studies are needed to evaluate the effect of the individual steps and eventual alternatives on niche outcomes. So far only limited number of studies published on the technique of a laparoscopic niche resection.\textsuperscript{16, 21-37} The largest cohort reported so far included 38 women.\textsuperscript{24} The technique applied by Donnez et al. is in general comparable to the technique as described above, in the exception that this group evaluates women with MRI, laser was used for the niche resection and the procedure was not performed under hysteroscopic evaluation.\textsuperscript{24}

**CONCLUSION**

We described the technique of a laparoscopic niche resection in ten steps and discussed possible alternative steps that may be the base for future studies. There is still room for improvement of the technique and as a consequence we should not implement it yet on a daily base. Preferably it should only be executed in research setting in centres of excellence with sufficient exposure.
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ABBREVIATIONS
CS: caesarean section; MRI: Magnetic resonance imaging.

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CONTRIBUTION TO AUTHORSHIP
JHU, HBR, WHE and RLE performed the laparoscopic niche resections. JHU and AVE drafted the manuscript and all authors made substantial contributions to it. All the authors critically revised this manuscript and approve with this version to be published.

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