

Laparoscopic Isthmocele (Niche) Correction as prevention in patients with fertility desire

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ABSTRACT

Objectives: To report the technique of Laparoscopic Isthmocele (Niche) Correction and surgical outcomes.

Material and methods: The retrospective study included only patients with current or potential fertility desire who had laparoscopic surgery for an isthmocele at the Academic Hospital Cologne Weyertal between the beginning of 2014 and the end of 2020. A total of 28 patients were included. Sonographic follow-up of myometrial thickness was performed in 67% cases.

Results: In 18% cases myometrial thickness was 5–7 mm, in 11% cases > 7–10 mm and in 39% cases > 10 mm. In the group with postoperative myometrium of 5–7 mm, two patients had preoperative residual myometrium of 2 mm, one patient of 2.5 mm and in one patient residual myometrium was not measurable (< 1 mm). In 11 patients, the postoperative myometrium was either greater than 10 mm and/or no isthmocele were detectable. There was an increase in mean preoperative myometrial thickness from 2 mm to a mean myometrial thickness of 8.7 mm (myometrial thickness increase to 335%).

Conclusions: In this study, laparoscopic correction of the isthmocele resulted in an increase in myometrial thickness from 2 mm to 8.7 mm (average values). This represents an increase in myometrial thickness of 335%. According to the literature review performed and based on our own results, we recommend prophylactic isthmocele correction in patients with fertility desire by means of laparoscopic procedure. Laparotomy should be performed only in special cases. Surgical hysteroscopy is not suitable for this purpose, but sufficient studies are still lacking.

Key words: Isthmocele; fertility desire; laparoscopy; niche; adenomyosis

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INTRODUCTION

In recent decades, there has been an increase in the caesarean section rate in developed countries. The average rate is 25.2% in Europe and 27.6% worldwide [1, 2]. This growing trend leads to more frequent diagnosis of uterine scar defect, which is called “niche” or “isthmocele” by several authors [3, 4]. Isthmocele is the integrity disorder of the myometrium at the caesarean scar [5]. A niche should be defined as an indentation at the site of the CS scar with a depth of at least 2 mm [6]. Diagnosis of isthmocele can be made by vaginal sonography, hysterosalpingography, hydrosonography, MRI or hysteroscopy [7, 8]. Uterine scar defect occurs increasingly and has been diagnosed in 61%

cases after one caesarean section and in 100% cases after three caesarean sections [9].

A uterine retroflexion increases the risk of isthmocele. The reason is thought to be increased tension at the scar during the healing process [10]. Postoperative adhesions between the uterine scar and the anterior abdominal wall (especially in the case of a uterine retroflexion) increase the risk of an isthmocele due to permanent traction on the scar [11].

Jordans et al. suggested the follow subclassified of the niche [6]:

- simple niche
- simple niche with one branch
- complex niche (with more than one branch).

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A branch was agreed to be a thinner part of the main niche, which is directed towards the serosa and has a width smaller than that of the main niche [6].

Based on the residual myometrium or the size of the scar defect, isthmoceles are classified in the following ways [12]:

- “large defect”: reduction of myometrium by > 50% (according to some authors by > 80%) or residual myometrium of < 3 mm,
- “small defect”: reduction of myometrium by < 50% or residual myometrium of \geq 3 mm.

Isthmoceles can be symptomatic (abnormal uterine bleeding, dysmenorrhea, dyspareunia, infertility, scar pregnancy) in 19.4% to 88% of cases [10]. Early diagnosis and treatment of isthmocele in patients with fertility desire is of particular importance because there is an increased risk of uterine rupture, placenta previa, placenta accreta/increta/percreta, secondary infertility, and ectopic gravidity in isthmocele [13]. The incidence of ectopic gravidity in the isthmoceles is one in 1688 pregnancies and is 4–6% between all ectopic pregnancies after at least one caesarean section [14, 15]. There is an increased risk of uterine rupture with a residual myometrium as small as 3 mm [7, 12]. The average risk for uterine rupture does not exceed two percent but increases to 5% for “large defect” [13].

Several authors have reported association between isthmocele and secondary infertility [16–20]. Two mechanisms are thought to cause infertility. On the one hand, fertility may be affected by the accumulation of fluid (blood, mucus) in the isthmocele affecting implantation dysfunction, sperm transport, and cervical mucosa; on the other hand, a chronic inflammatory reaction develops which also affects fertility [19–21]. This can lead to secondary infertility in 4% to 19% [22]. In addition, the isthmoceles, especially in a retroflected uterus, may affect the performance of insemination or embryo transfer due to difficult access to the cavity [23–25].

Currently, there is no clear guideline for the diagnosis and treatment of isthmocele [26]. Current treatment options consist of conservative therapy using hormonal preparations (for abnormal uterine bleeding) and surgical therapy using hysteroscopy, laparoscopy, laparotomy or vaginal access [11].

The decision for an appropriate therapy should be made based on symptoms, indication, results of imaging diagnostics and medical history.

MATERIAL AND METHODS

The retrospective study included only patients with current or potential fertility desire who had laparoscopic surgery for an isthmocele at the Academic Hospital Cologne Weyertal between the beginning of 2014 and the end of 2020. Diagnosis was mainly carried out using trans-

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> • Patients with fertility desire • At least one cesarean section in a medical history • Niche confirmed sonographically or by MRI in our department • Only patients who had endoscopic surgery (hysteroscopy and laparoscopy) in our department • Only patients who followed up in our department 	<ul style="list-style-type: none"> • Patients without fertility desire, who had surgery because of other complaints (e.g., dysmenorrhea, abnormal uterine bleeding) • Patients only with laparoscopy without hysteroscopy

vaginal sonography. A total of 28 patients were included in the study. Nine patients were referred by fertility centres before a planned artificial insemination. One patient had secondary infertility and in 18 patients it was prophylaxis of an obstetric complication before a planned next pregnancy. The following criteria were considered for the including of the patients to our study (Tab. 1). Simultaneous intraoperative hysteroscopy to evaluate the isthmoceles was performed obligatorily. This was followed by the planned laparoscopic correction. After bladder preparation, the isthmocele was visualized (Fig. 1, 2). Then the excision of the scar was performed with a monopolar needle. Then, under control of the cervical canal, the procedure of suturing was performed (Fig. 3–5).

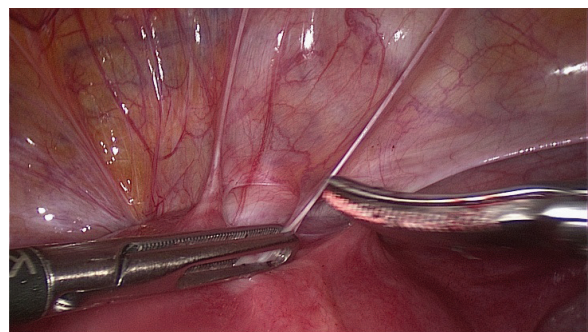


Figure 1. Bladder preparation

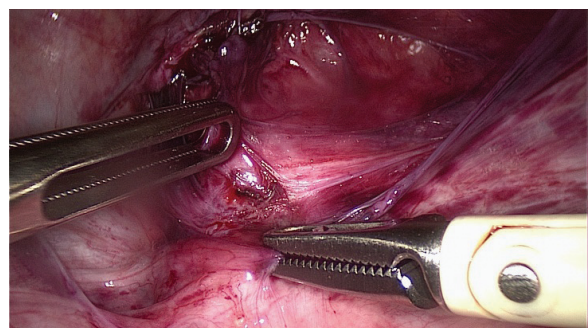


Figure 2. Representation of the isthmocele

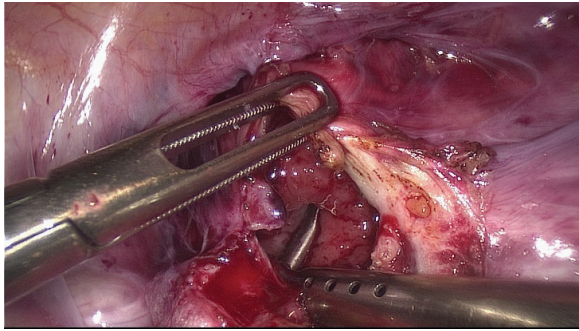


Figure 3. Checking the cervical canal

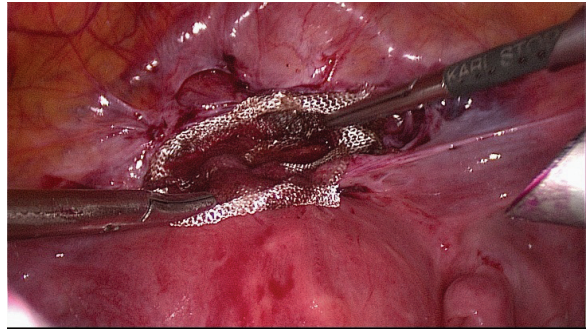


Figure 6. Mesh

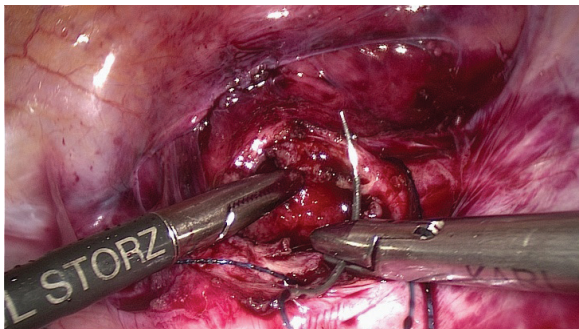


Figure 4. Suture

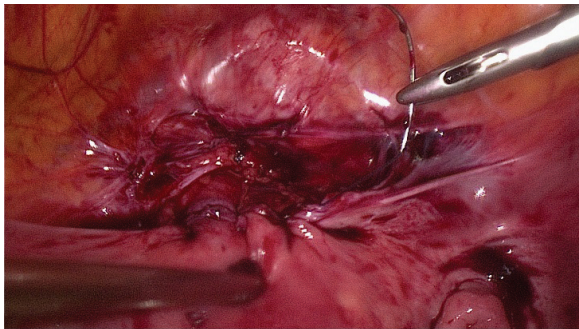


Figure 5. Suture

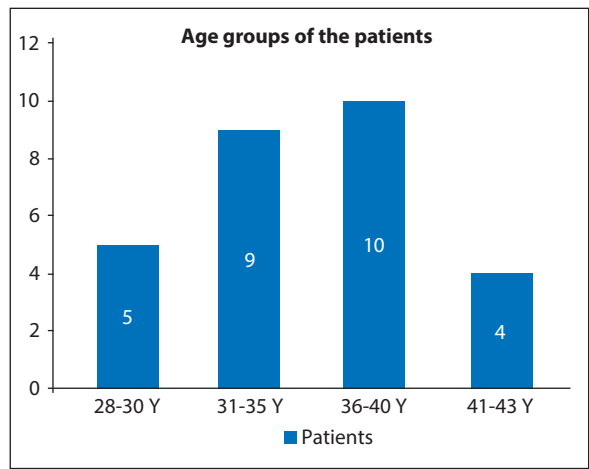


Figure 7. Overview of patients depending on age group, Y — years

RESULTS

The age of the patients was between 28 and 43 years. All patients were at reproductive age and had a current or potential desire to have children. Twenty-two patients had a history of one caesarean section and six patients had two caesarean sections. Table 2 shows the overview of preoperative sonographic findings regarding residual myometrium and uterine position related to patient number.

Intraoperative results

On diagnostic hysteroscopy, the isthmocoele was visible in 22 cases. In six cases, the isthmocoeles could not be seen.

In 17 cases, a single-layer continuous suture with Covidien V-Loc suture was performed, including the deep myometrial layer; in nine cases, a double-layer continuous

A Tabotamp mesh was placed over the uterine suture for adhesion prophylaxis (Fig. 6). Patients usually remained hospitalized for two days. The recommended waiting period was six months until the next pregnancy and primary caesarean re-section as the mode of delivery was recommended.

Restmyometrium*	large defect (< 3 mm)*	small defect (3 mm)*	small defect* (3–4 mm)
Number of patients	21 (74%)	3 (11%)	4 (15%)
Position of uterus	anteflexio	retroflexio	
Number of patients	22 (78.6%)	6 (21.4%)	

*Defined according to Marotta [11]

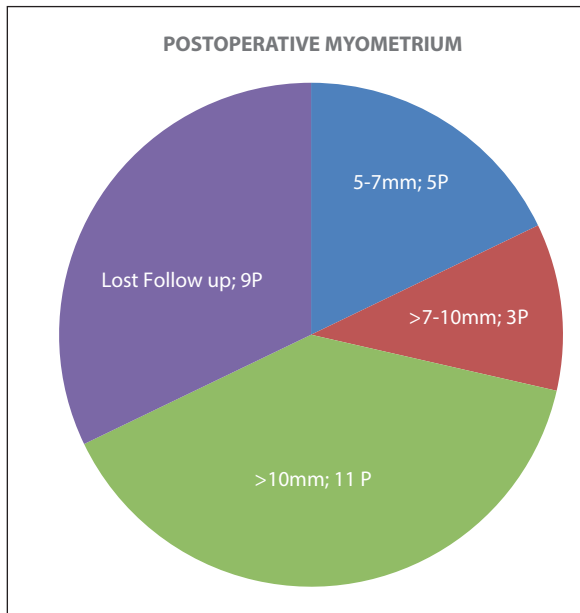


Figure 8. Postoperative myometrial thickness; P — patients

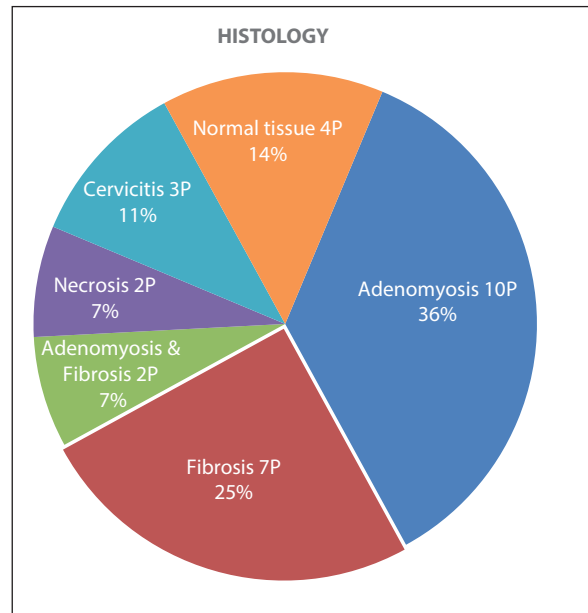


Figure 9. Histology in relation to number of patients; P — patients

suture with Covidien V-Loc suture was performed; and in two cases, Vicryl single-button sutures were performed.

In 14 cases, adenomyosis uteri was described at laparoscopy.

Postoperative results

Vaginal sonography performed postoperatively showed an increase of myometrial thickness (Fig. 8). Sonographic follow-up of myometrial thickness was performed in 67% cases (Fig. 8). In 18% cases myometrial thickness was 5–7 mm, in 11% cases > 7–10 mm and in 39% cases > 10 mm. In the group with postoperative myometrium of 5–7 mm, two patients had preoperative residual myometrium of 2 mm, one patient of 2.5 mm and in one patient residual myometrium was not measurable (< 1 mm). In 11 patients, the postoperative myometrium was either greater than 10 mm and/or no isthmoceles were detectable. There was an increase in mean preoperative myometrial thickness from 2 mm to a mean myometrial thickness of 8.7 mm (myometrial thickness increase to 335%).

Histology

The excised uterine scar was sent for histologic evaluation. Figure 9 shows the histological findings in relation to patient number.

In 68% (19 cases) of the findings were adenomyosis and/or fibrosis. In four cases in which the uterus was described intraoperatively as “adenomyotic altered”, no adenomyosis could be detected histologically. For a better overview, the overall findings of each patient are shown in a Table 3.

Most of the patients had a potential desire to have children and did not become pregnant by the time of the analysis. Only five patients got pregnant. Four out of five patients got a child per caesarean section and one patient had a miscarriage.

Special cases

In two cases (cases 1 and 7) surgical intervention for isthmocele correction had already been performed, before the patients presented to us. In one case it was an isthmocele revision with duplication of the section scar by transverse laparotomy. In another case, it was a laparoscopic suture of the sectional scar without prior revision of the scar. In both cases, the findings remained unchanged. After laparoscopic revision in our department, a good result was achieved (Tab. 3).

In one case (case 20), we performed a diagnostic hysteroscopy in which the isthmocele could be visualized, and a laparoscopic correction of the isthmocele was performed. Postoperatively, the isthmocele was not detectable by vaginal sonography. After nine months, the patient had a large corpus polyp, so surgical hysteroscopy was indicated and performed. During the operative hysteroscopy, the isthmocele was not seen this time. On the re-examination after two months, vaginal sonography showed an isthmocele recurrence, with residual myometrium of 3 mm. Subsequently, a new surgical intervention of the isthmocele by primary transverse laparotomy was performed in our department. The postoperative residual myometrium was 12.5 mm.

Table 3. Overview of the total findings in individual patients

Patient	Ages	Preop. Pregnancy	Preop. RM (mm)	Uterus Position	Postop. M (mm)	Postop. Pregnancy	Histology
1	35	1 S, 1 A	< 1	retrof	6.5	1 S	Adenomyosis
2	36	1 S, 1 A	< 1	antef	> 10	—	Adenomyosis, Fibrosis
3	34	1 S	< 1	antef	> 10	1 S	Necrose
4	34	1 S, 1 A	1	retrof	—	—	Adenomyosis
5	30	1 S	1	antef	—	—	Necrose
6	30	1 S, 1 A	1	antef	—	—	Cervicitis
7	31	1 S, 1 A	1	antef	7.6	—	Adenomyosis
8	28	1 S	1	antef	7.7	—	Cervicitis
9	33	1 S	1	antef	9.3	—	Adenomyosis
10	36	1 S	1.5	antef	—	—	Fibrosis
11	41	1 S	1.6	antef	—	—	Fibrosis
12	30	1 S	1.7	antef	—	—	Adenomyosis
13	39	S	2	antef	> 10	—	Normal Tissue
14	36	2 S	2	antef	7	—	Normal Tissue
15	35	1 S, 1 A	2	retrof	> 10	—	Adenomyosis
16	36	1 S	2	retrof	—	—	Adenomyosis
17	37	2 S	2	antef	7	—	Fibrosis
18	38	1 S	2.2	antef	—	—	Fibrosis
19	38	1 S	2.3	antef	10	1 A	Fibrosis
20	41	1 S	2.4	antef	> 10	—	Adenomyosis, Fibrosis
21	36	1 S, 1 A	2.5	antef	5	—	Adenomyosis
22	35	1 S	3	antef	> 10	1 S	-
23	43	1 S	3	retrof	> 10	—	Adenomyosis
24	37	2 S	3	antef	> 10	—	Normal Tissue
25	33	2 S	3,	antef	> 10	—	Fibrosis
26	41	2 S, 2 A, 1 EUG	3.5	antef	—	—	Fibrosis
27	34	2 S, 2 A	3.8	antef	> 10	—	Adenomyosis
28	30	1 S	4	antef	5.2	1 S	Cervicitis

A — Abort; antef — Ante flexio; M — Myometrium; retrof — Retro flexio; RM — Residual Myometrium; S — Sectio

DISCUSSION

For the first time, “isthmocele” was described by Morris in 1995, as a defect of the anterior uterine wall in the isthmus area at the location of the sectional scar [21]. Verwoort et al. [27] proposed four theories that could explain the development of the isthmocele:

1. A very deep incision during caesarean section.
2. Inadequate suture care during caesarean section (especially in the case of secondary section).
3. Surgical interventions that promote adhesion formation (e.g., no closure of the peritoneum, inadequate hemostasis, etc.).
4. Genetic predisposition to wound healing disorder.

We suspect that adenomyosis uteri and fibrosis of the tissue favor the formation of isthmocele. Thus, adenomyosis and/or fibrosis were found in 68% of our cases. Donnez

et al. [22] showed the presence of fibrosis in 79% cases and adenomyosis in 21% after histological workup of the scar tissue. However, the sufficient studies for this are still lacking.

Isthmocele may be symptomatic or asymptomatic [11]. Symptoms/complications are divided into:

- Gynecologic: abnormal uterine bleeding, postmenstrual spotting, dysmenorrhea, lower abdominal pain, and secondary infertility [28–30] and
- Obstetric: Suture dehiscence, uterine rupture, placenta previa, placenta accreta/increta/percreta, ectopic gravidity in the isthmocele [10, 13].

Schepker et al. operated on nine patients with a symptomatic isthmocele by mini-laparotomy [31]. They showed a benefit in terms of bleeding symptoms, secondary infertility, and lower abdominal pain. In their work, Pomorski

et al. showed the residual myometrium follow-up in seven patients in whom a "large defect" isthmocele was corrected by mini-laparotomy [32]. The mean preoperative residual myometrium was 1.9 mm. The postoperative myometrium 2–3 days after laparotomy averaged 8.8 mm and 3 months after surgery 8.0 mm.

Vervoort et al. and Donnez et al. performed large studies in which they performed laparoscopic isthmocele correction in 101 and 38 patients, respectively [5, 22]. In both papers, the study was non-selective, so patients with different symptoms and surgical indications were included in the study. They showed a positive outcome in terms of both symptom relief and residual myometrium. Donnez et al. described improvement in bleeding symptoms and lower abdominal pain in 91% of cases [22]. Eight of 18 patients with secondary infertility became pregnant [22]. Vervoort et al. showed improvement of symptoms in 79.2% (80 patients) of cases [5]. Postoperative measurement of myometrium was performed in the 87 patients. The average myometrial thickness increased from 1.2 mm to 5.3 mm, with a myometrium of > 5 mm in 57.1% (48 patients) of cases [5]. Liu et al. performed laparoscopic correction in 49 patients with an isthmocele and associated bleeding problems [33]. The average residual myometrium was 2.2 mm. They achieved improvement of symptoms in 89.8% (44/49). In 95.9% cases (47/49), sonographic control could no longer detect an isthmocele.

According to the literature review and based on the results of the present study, a positive outcome was demonstrated after isthmocele correction by both laparotomy and laparoscopy [5, 22, 31, 32]. The authors of the present study

are of the opinion that laparoscopic procedure should be preferred due to significantly less morbidity as the primary option. Isthmocele correction by laparotomy should be performed only in special cases (e.g., unsuccessful laparoscopic procedure, complex adhesions).

The hysteroscopy procedure is a minimally invasive procedure with short operative time and minimal morbidity [34]. However, there is an increased risk of uterine perforation and bladder injury [12]. The hysteroscopy procedure is recommended when the residual myometrium is > 3 mm to reduce this risk [12]. The hysteroscopy procedure has a positive outcome in terms of secondary infertility and bleeding symptoms [20, 34]. However, we believe that hysteroscopy resection has no benefit in terms of obstetric complications on the one hand, and on the other hand, it can further reduce the residual myometrium. Moreover, in our study, the isthmocele could not be visualized hysteroscopically in six cases (22%). For this reason, we do not recommend the hysteroscopy procedure for the prophylactic correction of isthmocele in patients with fertility desire, but only for the treatment of bleeding problems. Table 4 shows the overview of the results after the literature review.

CONCLUSIONS

In this study, laparoscopic correction of the isthmocele resulted in an increase in myometrial thickness from 2 mm to 8.7 mm (average values). This represents an increase in myometrial thickness of 335%. According to the literature review performed and based on our own results, we recommend prophylactic isthmocele correction in patients with fertility desire by means of laparoscopic procedure. Lapa-

Table 4. Literature overview

Literature	Method	The number of patients	Results
Schepker et al. [31]	Laparotomy	9	In 100% cases of improvement of bleeding symptoms, 60% patients (3 out of 5) became pregnant
Pomorski et al. [32]	Laparotomy	7	Preoperative average remaining myometrium: 1.9 mm Postoperative average myometrium: 8–8.8 mm
Gubbini et al. [20]	Hysteroscopy	41	100% pregnancy rate (41 of 41)
Abacjew-Chmylko et al. [34]	Hysteroscopy	Review of 11 studies	Improvement of complaints in 85.5% cases
Vervoort et al. [5]	Laparoscopy	101	Improvement of complaints in 79.2% cases Preoperative average remaining myometrium: 1.2 mm Postoperative average myometrium (87 cases): 5.3 mm
Liu et al. [33]	Laparoscopy	49	Improvement of bleeding complaints in 89.8% cases (44/49) Preoperative average residual myometrium 2.2 mm. In 95.9% cases (47/49) no isthmocele could be detected postoperatively
Donnez et al. [22]	Laparoscopy	38	Improvement of bleeding complaint and lower abdominal pain in 91% cases. 18 patients with II° sterility became pregnant
The present study	Laparoscopy	28	Preoperative average residual myometrium: 2 mm Postoperative average myometrium: 8.7 mm

rotomy should be performed only in special cases. Surgical hysteroscopy is not suitable for this purpose, but sufficient studies are still lacking.

Ethical approval

After a written request by email to the North Rhine Medical Association, according to 15§ of the professional code of the North Rhine Medical Association, neither advice nor an ethics vote is necessary for a retrospective study.

Informed consent

Because the retrospective nature of the study and the patients' private data were not used, informed consent was not required in accordance with a specific permission decision.

Conflict of interests

All authors declare no conflict of interest.

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