Surgical Therapy of Endometriosis: Challenges and Controversies

Herausforderungen und Kontroversen bei der operativen Therapie der Endometriose

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Abstract

Endometriosis is one of the most common disorders encountered in surgical gynaecology. The laparoscopic technique, the planning of the surgical intervention, the extent of information provided to patients and the interdisciplinary coordination make it a challenging intervention. Complete resection of all visible foci of disease offers the best control of symptoms. However, the possibility of achieving this goal is limited by the difficulty of detecting all foci and the risks associated with radical surgical strategies. Thus, the excision of ovarian endometrioma can result in a significant impairment of ovarian function, while damage to nerve structures during resection of the uterosacral ligaments, the parametrium, the rectovaginal septum or the vaginal cuff to treat deep infiltrating endometriosis can lead to serious functional impairments such as voiding disorders. A detailed risk-benefit analysis is therefore necessary, and patients must be treated using an individual approach.

Zusammenfassung

Die Endometriose gehört zu den häufigsten Krankheitsbildern in der operativen Gynäkologie mit erheblichen Herausforderungen an die laparoskopische Technik, aber auch die OP-Planung, Patientinnenaufklärung und Interdisziplinarität. Ziel im Hinblick auf eine bestmögliche Symptomkontrolle ist die vollständige Entfernung der erkennbaren Krankheitsherde, die aber limitiert wird durch nachweisliche Grenzen der Detektierbarkeit und die Risiken radikaler Operationsstrategien. So kann die Exzision ovarieller Endometriome zu einer signifikanten Beeinträchtigung der Ovarialfunktion, die Läsion nervaler Strukturen bei der Resektion tief-infiltrierender Endometriose der Sakrouterinligamente, der Parametrien, des Septum rectovaginale und des Vaginalpols zu schwerwiegenden Funtionsbeeinträchtigungen wie Blasenentleerungsstörungen führen. Eine gründliche Nutzen-Risiko-Abwägung muss daher symptomorientiert erfolgen und in einem individualisierten Vorgehen resultieren.

Introduction

Endometriosis is one of the most common gynaecological disorders but also one of the greatest challenges facing gynaecological surgeons [1]. A guideline-oriented approach [2], extensive experience of surgical techniques and interdisciplinary cooperation [3] are the prerequisites for successful treatment.

A detailed history of individual symptoms, adequate diagnostics and special surgical skills are indispensable for diagnosing endometriosis and for preoperative planning and surgery [4]. It is also important that the surgeon and patient take the time to consider the "difficult", in some instances, controversial, and potentially risky aspects of possible surgical interventions.

Factors to consider include individual risks, such as the risk of recurrence, as well as factors intrinsic to the disease and the risks associated with the surgical technique. This paper discusses several such combinations which deserve particular consideration due to their prevalence and potentially serious consequences.

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Extent of Surgery and Dealing with Unexpected Findings

Both from the surgeon's and the patient's point of view, the extent of the actual manifestation of disease and the associated extent of the planned surgery are the most important preoperative considerations, but these are also the factors which are most difficult to assess preoperatively. Frequently, the extent of surgery will only become clear intraoperatively.

The lines of resection are primarily determined by the extent of disease spread. The goal of surgery is complete resection, which can include resection of parts of the intestine and involve the ureters and bladder [5–11].

In addition to the necessary surgical experience, a good interdisciplinary cooperation and close involvement of the patient are important during the planning stage. Despite adequate diagnostics, it may be necessary to broaden the scope of the primary intervention. This may also be unexpectedly necessary during surgery, for example, if there is intestinal involvement beyond the rectovaginal septum or non-obstructive involvement of the ureter (**Fig. 1 a** and **b**).

This not untypical constellation represents a considerable challenge as regards the information routinely provided to the patient preoperatively and for surgical logistics. The problem is commonly tackled using one of two approaches: either a flexible surgical strategy with the patient given a maximum of information about all eventualities or a two-stage approach compatible with the disease constellation. It is important in every individual case to weigh up the psychological burden for the patient which may be affected by the amount of information given (which may be far too extensive) and, depending on the structure of the hospital department, the possibly unnecessary allocation of operating room capacity and interdisciplinary personnel resources against the disadvantages of a second operation.

In each case, clear positioning during preoperative planning is recommended to guard against surprises.

In addition to the extent of endometriosis, secondary factors such as the presence of adhesions or, in the case of the retroperitoneal space, the presence of fibrotic lesions also have a significant impact on surgery. These factors can change the anatomy to such an extent that extensive dissection is necessary for reconstruction. Intestinal adhesiolysis and extensive ureterolysis may be required to reach the endometriotic lesion and to avoid iatrogenic injury to structures close to the margins of the endometriotic lesion. At the same time, dissection is also associated with an intrinsic risk of injury.

Injuries are by no means rare; in fact, they are fairly common, particularly when treating deep infiltrating endometriosis, and require awareness and appropriate discussion preoperatively.

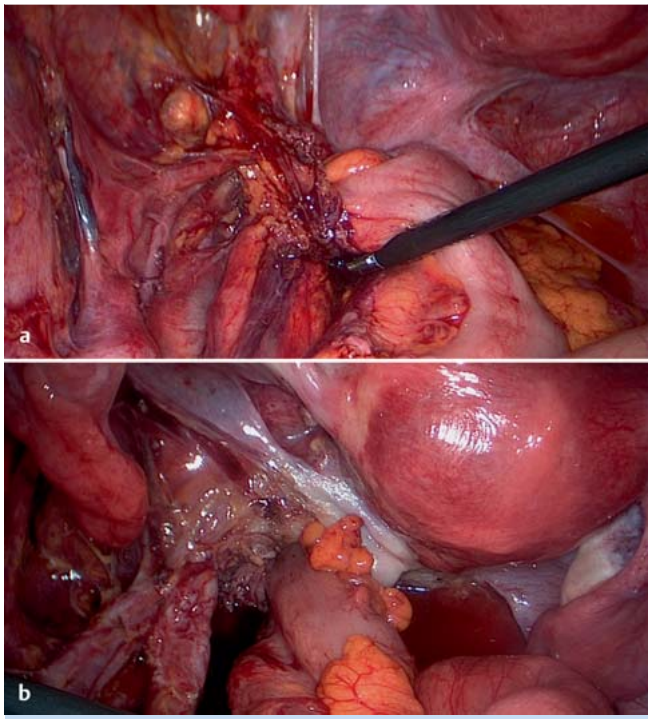

Fig. 1 a and **b** **a** Involvement of the left ureter in a case with rectosigmoid endometriosis. **b** After ureterolysis and rectosigmoid resection.

Fig. 2 Peritoneal endometriosis with unclear extent and spread: red lesions with typical vascular patterns next to fibrotic peritoneal defects.

Limits of Detectability of Endometriotic Lesions and Differentiation from Healthy Tissue

The detection and differentiation of endometriotic lesions from healthy tissue is a challenge (**Fig. 2**), particularly in cases of recurrence.

Out of a total of 39 patients with persistence of complaints after excision or ablation of histologically verified endometriosis, repeat laparoscopy found peritoneal recurrence in 37%. Recurrence occurred significantly more frequently in previously operated (RR 2.54; 95% confidence interval [CI]: 1.63–3.97) or immediately adjacent (RR 1.29; 95% CI: 0.84–2.0) areas compared to areas distant to the original localisation, which supports the hypothesis that primary resection was probably incomplete [12]. The reason for this could be that endometriotic lesions in the peritoneum can extend far beyond the visible foci, as has been shown in examinations using scanning electron microscopy [13]. The presence of residual foci of endometriosis in a number of patients could also explain the success of a combined approach using surgery and hormone therapy. This interpretation is supported by the results of a prospective randomised study in 450 patients which compared outcomes after surgery, hormone therapy or combined surgery and hormone therapy. The combined approach had significantly better results, with a 60% success rate as measured by the clinical parameters "dysmenorrhea" and "dyspareunia" and findings at second-look laparoscopy, com-

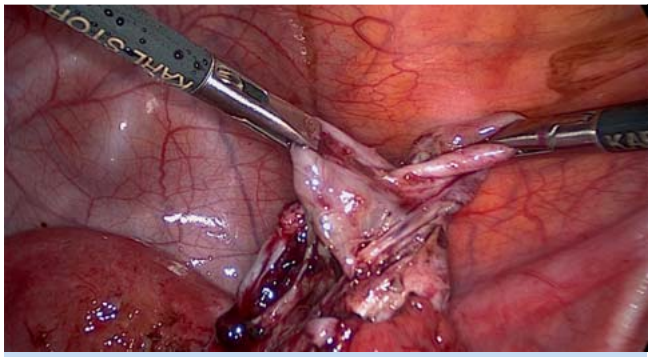

Fig. 3 Meticulous dissection to expose the cleavage plane in right-sided ovarian endometriosis.

pared to rates of 55% for exclusively hormone therapy and 50% for exclusively surgical treatment [14].

Radical Dissection: Opportunities and Risks

Peritoneal endometriosis

Exclusively endocrine therapy has been shown to have results comparable to the outcomes after surgery, at least for peritoneal endometriosis. Given the existing uncertainty about detecting the extent of endometriotic lesions and the potential use of exclusively endocrine therapy as an alternative to surgery [15,16], it is important in individual cases to weigh the extent of the potential excision against the risk of overtreatment.

Ovarian endometriosis

After peritoneal endometriosis, the ovaries are the second most common site for endometriosis. But although surgery to treat ovarian endometriomas is assumed to be a routine procedure, it involves particular challenges for the surgeon.

As the reported rate of recurrence ranges from 9.6–45.5% [17, 18], the surgeon must weigh the necessity for adequate excision against the potential iatrogenic decrease in ovarian reserve. Analysis of anti-Müllerian hormone (AMH) levels showed that surgery for ovarian endometriosis was associated with a significant decrease in AMH concentrations [19–21]. AMH levels decreased by 24% after unilateral surgery and by up to 67% after bilateral surgery [22,23].

Meticulous dissection to expose the correct cleavage plane (**Fig. 3**) by an experienced surgeon taking special care to preserve the ovarian hilum is recommended as the optimal surgical technique [24–26]. The benefits of excision as opposed to electrosurgical ablation have been demonstrated and confirmed in an extensive meta-analysis [27–29]. The analysis by Dan and Limin [29] compared the data of seven studies and found that, compared to ablation, excision was associated with a significantly reduced risk of symptom recurrence (RR 0.29; 95% CI: 0.15–0.55; $p < 0.001$) and a significantly reduced rate of recurrence (RR 0.50; 95% CI: 0.26–0.97; $p = 0.04$). Recurrence rates after excision were also lower compared to laser vaporisation (RR 0.33; 95% CI: 0.12–0.88; $p = 0.03$). The achieved pregnancy rates after excision were also significantly better compared to electrosurgical coagulation (RR: 2.64; 95% CI: 1.49–4.69; $p < 0.001$), but not compared to laser vaporisation (RR: 0.92; 95% CI: 0.30–2.80; $p = 0.89$). Data on ovarian reserve was not analysed in this meta-analysis.

One study postulated that impairment of ovarian function could be prevented by replacing bipolar coagulation with a haemostatic suture [30], but this could not be confirmed in a prospective randomised study; instead, it was found that AMH levels decreased, irrespective of the technique used [31].

The indication for surgery requires the potential benefits of better pain management or better access to growing follicles in IVF, which would otherwise be obscured by endometrioma, to be weighed against a potentially significant impairment of ovarian reserve [32]. It is, of course, obvious that unclear ovarian masses need to be identified histologically.

Deep infiltrating endometriosis

The indication for surgery for deep infiltrating endometriosis is usually severe pain. Complete excision may require expanding the procedure to include the vagina, intestines and ureters, but complete surgery has been shown to control symptoms and reduce the rate of recurrence [7,33–35]. The majority of procedures can be carried successfully using laparoscopy; the rate of conversion to laparotomy is between 1.6 and 12% [36–38].

In addition to the demanding surgical technique which requires a high degree of specialisation, other major challenges are planning and correctly determining the extent of surgery. A risk-benefit analysis weighing the benefits of pathological and anatomical radicality against benefits and risks of more limited procedures may be necessary. The question whether limited surgery could potentially not increase the rate of recurrence if the remnants left in situ in the intestine or vagina were asymptomatic preoperatively is still discussed controversially [39], but can obviously not always be estimated properly.

For specialised centres, the reported complication rates in the immediate postoperative period are 2–4% [8,9], the overall rate of serious complications is 7–9% [36–38,44] and the rate of recurrence is 8–13% [38,40–42]. In view of the complexity of the intervention, these rates appear to be within "acceptable" ranges. However, the potentially serious nature of early and late complications and unwanted side-effects and outcomes may make the final result after surgery almost insupportable for individual patients.

Factors which need to be taken into account range from the general risks which depend on the extent of the intervention to the specific risks of surgery for endometriosis.

General risks can be irrespective of the diagnosis of endometriosis. For example, observational studies have reported a causal association between lengthy surgical procedures with the patient in the lithotomy position and serious lower limb compartment syndrome [43,44].

Colorectal surgery is a common endometriosis-specific risk. In one case series, revision surgery after segmental resection was required in the first week after primary surgery in 4.1% of cases [9]. Anastomotic insufficiency was reported in 0.7–3% of cases [36,45].

A protective ileostomy is done in 3–14.5% of cases. One study reported the regular creation of a protective ileostomy during surgery in 95.2% of cases [36,38,45,46]. From a surgical point of view, this is not a complication but a necessary measure to avoid complications, but for a young woman with endometriosis this frequently constitutes a barrier against intervention when taking the decision to undergo surgery.

Another study reported late functional impairments which took the form of either severe constipation or pathologically increased frequency of daily stools in 52% of patients who had segmental

resection, and in 19% of patients who had nodule resection [47]. When surgery is adapted intraoperatively, the goal is to reduce the radicality of the procedure as far as possible. Less radical surgical techniques include the so-called shaving technique to preserve the intestinal wall [42] and discoid resection instead of segmental resection to preserve bowel continuity [48,49]. Unfortunately there are no comparative prospective studies for these techniques. But adequate complete resection of the endometriotic nodule must be ensured, as otherwise there is an increased risk of recurrence. In the study of Brouwer and Woods, the recurrence rates of 2.19% after segmental rectal resection and 5.17% after full-thickness excision of the anterior rectal wall rose significantly to 22.2% after what was probably incomplete dissection off the rectal wall [45].

Another study reported severe urological complications such as hydronephrosis in 4.8%, urinary fistulas in 3% and bladder voiding dysfunction in 28.9% after colorectal resection with partial colpectomy [50].

Voiding dysfunction rates after resection are reported to be 15–30%, but voiding dysfunction is likely to affect the majority of all patients in a mild and transient form after complex resection of deep infiltrating endometriosis and can even result in a permanent need for self-catheterisation. The cause of voiding dysfunction is autonomic nerve damage, particularly iatrogenic injury to the inferior hypogastric plexus at the proximal portion of the uterosacral ligament during resection of the uterosacral ligaments, of the parametrium, the deep rectum and the vaginal cuff [51–53] (**Fig. 4a** und **b**). Postoperative rates of urinary dysfunction could be reduced if nerve structures are identified and spared intraoperatively [54,55].

If hydronephrosis is present, ureteral involvement must always be considered; however, ureteral involvement may be silent and completely asymptomatic [56]. In one study of patients with retrocervical endometriosis in the vicinity of the uterosacral ligaments, ureteral involvement was present in 17.9% of cases with nodules ≥ 3 cm compared to 1.6% of cases with nodules < 3 cm [57]. Ureterolysis was reported to be successful in the majority of cases (53.8–73.3%) [56,58,59], but complication rates were between 23 and 31.4% [58,59].

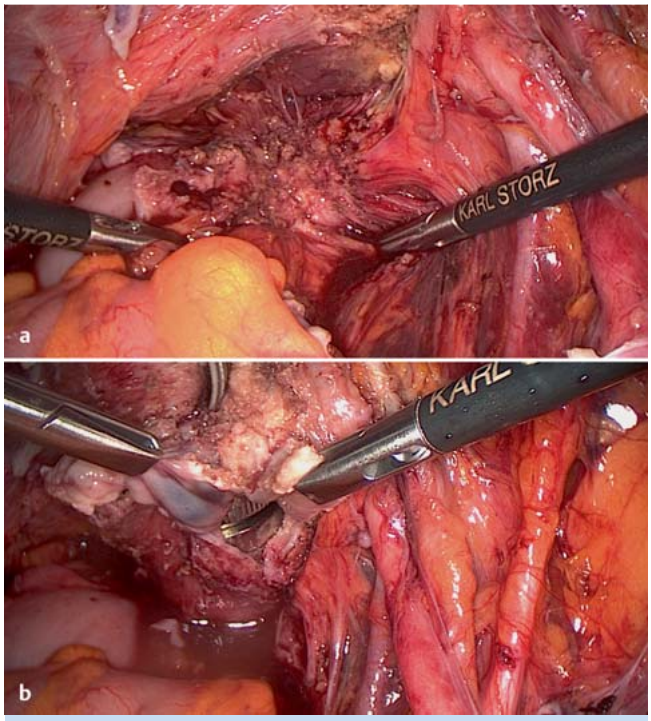

Fig. 4a and **b** **a** Endometriotic nodules with infiltration of the vaginal cuff; the fibres of the right inferior hypogastric plexus are immediately lateral to the nodules. **b** Resection of vaginal endometriosis preserving the inferior hypogastric plexus.

Special Situations: Adolescence and Recurrence

Both situations, although completely dissimilar, confront the surgeon with the same necessity to weigh the benefits against the risks of an invasive or repeat invasive procedure.

In adolescence, qualms about the invasiveness of laparoscopy may result in a delay in diagnosis of several years [60]. Further systematic reviews will be necessary to confirm the data of one study which reported the prevalence of endometriosis to be 70–75% in girls with therapy-resistant, chronic, pelvic pain and dysmenorrhea [61]. The limited data available on treatment outcomes is controversial. One study came to the conclusion, based on the data for re-interventions, that early laparoscopic excision had the potential to eradicate disease [62]. Another study of 57 women ≤ 21 years who underwent laparoscopy for endometriosis reported an unusually high rate of 56% of patients suspicious for recurrence and a constant increase in recurrence rates over the 5-year follow-up period and concluded, based on these data, that early surgical intervention was associated with a particularly high risk of recurrence [63].

Caution is advised with regard to re-operations of patients with symptomatic recurrence, particularly patients who have had repetitive surgical interventions for endometriosis. The cumulative probability for further surgical interventions was found to be at least 15–20%, although the authors of the study surmised that publication bias meant that these data were probably an underestimate [64]. Re-operation for recurrence and pelvic pain was as efficacious as primary surgery and had comparable limitations [65]; however, with regard to the desire for conception, pregnancy rates after re-operation were only half of those achieved after primary operation.

Conclusion

The aim of this overview was to discuss controversial aspects and challenges in the surgical treatment of endometriosis. This discussion has made it clear that significant challenges still remain with regard to preoperative diagnosis and decision-making, the provision of information to patients and surgical techniques to treat endometriosis.

Conflict of Interest

None.

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