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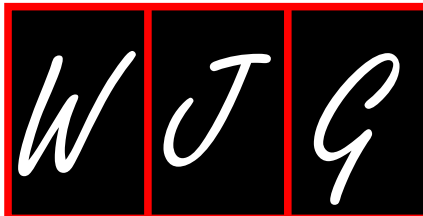
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Bowel endometriosis: Colorectal surgeon's perspective in a multidisciplinary surgical team

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Abstract

Endometriosis is a gynecological condition that presents as endometrial-like tissue outside the uterus and induces a chronic inflammatory reaction. Up to 15% of women in their reproductive period are affected by this condition. Deep endometriosis is defined as endometriosis located more than 5 mm beneath the peritoneal surface. This type of endometriosis is mostly found on the uterosacral ligaments, inside the rectovaginal septum or vagina, in the rectosigmoid area, ovarian fossa, pelvic peritoneum, ureters, and bladder, causing a distortion of the pelvic anatomy. The frequency of bowel endometriosis is unknown, but in cases of bowel infiltration, about 90% are localized on the sigmoid colon or the rectum. Colorectal involvement results in alterations of bowel habits such as constipation, diarrhea, tenesmus, dyschezia, and, rarely, rectal bleeding.

Differential diagnosis must be made in case of irritable bowel syndrome, solitary rectal ulcer syndrome, and a rectal tumor. A precise diagnosis about the presence, location, and extent of endometriosis is necessary to plan surgical treatment. Multidisciplinary laparoscopic treatment has become the standard of care. Depending on the size of the lesion and site of involvement, full-thickness disc excision or bowel resection needs to be performed by an experienced colorectal surgeon. Long-term outcomes, following bowel resection for severe endometriosis, regarding pain and recurrence rate are good with a pregnancy rate of 50%.

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Key words: Endometriosis; Colorectal endometriosis; Deeply infiltrative endometriosis; Laparoscopy; Diagnosis; Treatment

Core tip: Multidisciplinary laparoscopic treatment of extensive endometriosis with bowel involvement has become the standard of care. Depending on the size of the bowel lesion and site of bowel involvement, full-thickness disc excision or bowel resection needs to be performed by an experienced colorectal surgeon. This narrative review discusses in depth the role of a colorectal surgeon in a multidisciplinary team treating bowel endometriosis. From clinical and diagnostic work-up to surgical treatment for different colorectal localizations of endometriosis, each issue is addressed. Furthermore, postoperative outcomes, regarding symptom control, recurrence, and fertility, are discussed.

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INTRODUCTION

Endometriosis is a common health disorder in women, which is defined as the presence of endometrial-like tissue outside the uterus, inducing a chronic inflammatory reaction. The three clinical presentations are peritoneal endometriosis, endometriotic ovarian cysts (endometriomas), and deeply infiltrative endometriosis or deep endometriosis (DE)^[1]. DE is defined as endometriosis located more than 5 mm beneath the peritoneal surface. It is mostly found on the uterosacral ligaments, inside the rectovaginal septum or vagina, in the rectosigmoid area, ovarian fossa, pelvic peritoneum, ureters, and bladder. DE can cause a complete distortion of the pelvic anatomy^[2]. This review specifically focuses on the role of a colorectal surgeon in the treatment of DE in a multidisciplinary setting. Therefore, the aim of this paper is to underline the point of view of a colorectal surgeon in the multidisciplinary therapy of bowel endometriosis.

CLINICAL FEATURES OF BOWEL ENDOMETRIOSIS

Endometriosis occurs during the active reproductive period. It is estimated that up to 15% of all women of reproductive age have endometriosis. About one-third of infertile women suffer from endometriosis^[3]. Endometriosis affects the bowel in 3%-37% of all cases^[4], and in 90% of these cases the rectum or sigmoid colon are also involved^[5,6]. The histopathological diagnosis of endometriosis is usually straightforward. The term "bowel endometriosis" should be used when endometrial-like glands and stroma infiltrate the bowel wall reaching at least the subserous fat tissue or adjacent subserous plexus^[7]. In general, the most common presenting clinical features are pelvic pain and infertility. The natural history of the disease has never been well defined due to the asymptomatic nature of the disease in many women. Even women with bowel endometriosis may be asymptomatic. For these patients, the clinical course appears to be benign, and surgical resection is probably not indicated, especially when there is no associated infertility. In women with moderate to severe disease, some degree of intestinal symptoms may be present. Intestinal symptoms due to endometriosis may vary depending on location and menstrual cycle^[8]. Symptoms of endometriosis can be non-specific with considerable overlap with other clinical conditions, delaying a diagnosis and treatment. Moreover, physical examination, especially vaginal examination, may be completely normal, which hampers the diagnosis in young females. Chronic pelvic pain, often more severe during menstruation or at ovulation, is the most common symptom associated with endometriosis. Rectal involvement may result in alterations in bowel habits such as

constipation, diarrhea, dyschezia, tenesmus, and, rarely, rectal bleeding. Differential diagnosis must be made with irritable bowel syndrome, solitary rectal ulcer syndrome and a rectal tumor^[9]. Although colonic endometriosis may be asymptomatic, it can also present as large bowel obstruction. Colonic endometriosis must be differentiated from Crohn's disease, diverticular disease, adhesions, or neoplasm. Also for small bowel implants secondary to endometriosis, difficulty exists to differentiate this condition from Crohn's disease, because a similar endoscopic and histologic image can be seen. Intestinal perforation due to endometriosis may occur in the colon^[10] and also in an appendix with transmural endometriosis.

DIAGNOSIS AND PREOPERATIVE WORK-UP

Preoperative work-up is essential in planning a multidisciplinary surgical treatment and is usually done by the gynecologist. Precise diagnosis is necessary with regard to location and extent of bowel endometriosis. For the evaluation of bowel endometriosis, with or without involvement of the rectovaginal septum, transvaginal ultrasonography, barium enema examination, and magnetic resonance imaging (MRI) are the imaging techniques of choice. These technical investigations should aim to: (1) document the extent of the disease; (2) help in planning a multidisciplinary treatment; and (3) counsel patients regarding postoperative complications. Transvaginal ultrasonography is a non-invasive tool, available at the gynecological outpatient clinic (Figure 1). DE can be detected as a heterogeneous, hypo-echoic, and sometimes spiculated mass^[11]. According to a recent meta-analysis, bowel endometriosis can be diagnosed by transvaginal ultrasound with pooled estimates of sensitivity and specificity of 91% and 98%, respectively^[12]. If bowel endometriosis is suspected, a barium enema examination is performed to investigate the extent of the disease (Figure 2). Deep invasion of the bowel wall appears as an extrinsic mass compressing the bowel lumen in association with fine crenulation of the mucosa in this particular region. Also, bowel strictures at the rectosigmoid junction can be seen. Based on this diagnostic potential, barium enema can guide the colorectal surgeon regarding the level of dissection, although the exact distance to the anal sphincter cannot be measured^[13]. MRI can be helpful in diagnosis of multifocal endometriosis as well as in defining the condition's anatomical location. A contrast enhanced mass or hyperintense foci on T₁-weighted or fat-suppression T₁-weighted MRIs strongly suspect the presence of hemorrhagic foci or hyperintense cavities secondary to endometriosis. A hypointense nodule can be seen on T₂-weighted images with the signal of the tissue mass close to that of pelvic muscles. The sensitivity and specificity of MRI, to detect pelvic endometriosis, is around 90%^[14,15]. Rectosigmoidoscopy or colonoscopy are of little value in the diagnosis of bowel endometriosis, because endometriosis is an extrinsic, typically a non-

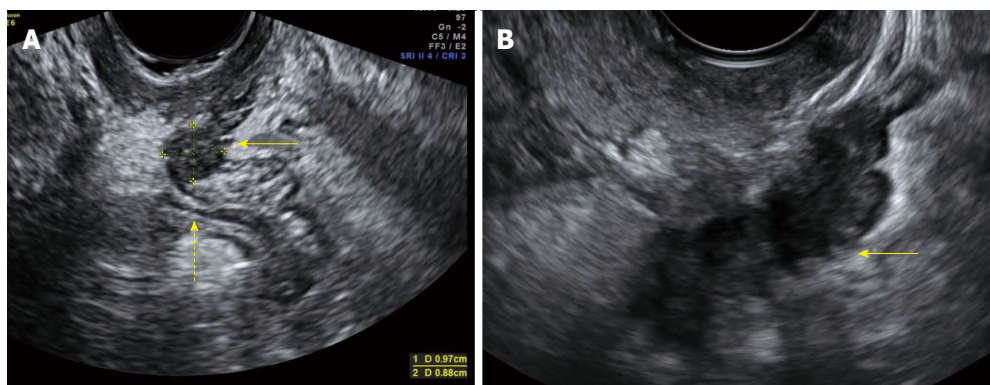


Figure 1 Transvaginal ultrasound image, sagittal view. A: Hypoechoic nodule in the rectovaginal septum measuring 1 cm × 0.9 cm (arrow). The nodule obliterates the pouch of Douglas, invades the anterior rectal wall, and causes anatomical distortion (dotted arrow); B: A large hypoechoic retrocervical nodule affecting the recto-sigmoid colon is seen (arrow). Note the typical “indian headdress sign”, indicating deep endometriosis into the bowel wall.

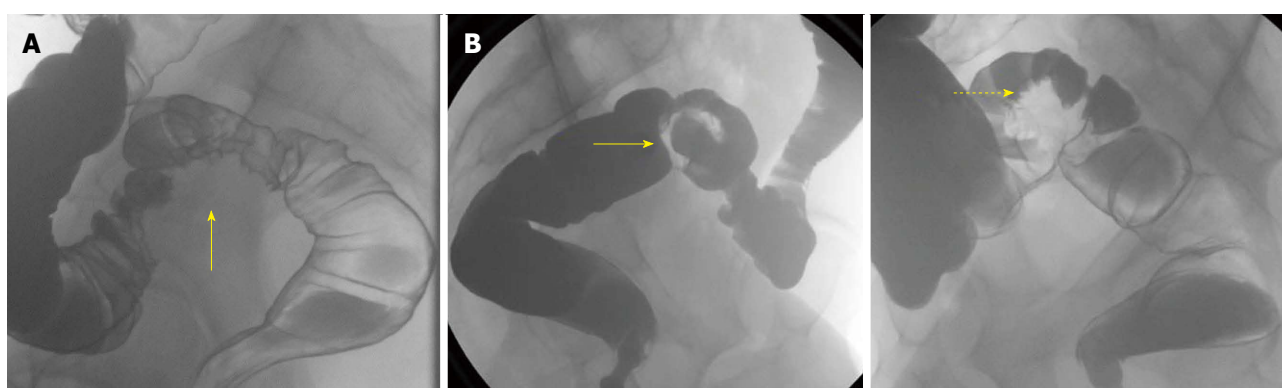


Figure 2 Barium enema, sagittal view. A: Extrinsic mass compressing the rectum secondary to severe pelvic endometriosis (arrow); B: Stricture of the sigmoid colon secondary to endometriosis (arrow). Note the fine crenulation of the mucosa (dotted arrow).

transmural disease.

OPERATIVE TREATMENT

The abovementioned imaging techniques are required to adequately assess the extent of endometriosis. However, exploratory laparoscopy is the gold standard to diagnose and to uniformly classify endometriosis^[4]. Exploratory laparoscopy allows for examination of the uterus along with the uterosacral ligaments, ovaries and ureters, the sigmoid colon, and the upper rectum. The accuracy of exploratory laparoscopy is investigator-dependent and should be performed by an experienced gynecologist in cooperation with a colorectal surgeon. However, the pouch of Douglas cannot always be exposed, and rectovaginal endometriosis can be difficult to diagnose because of its intraperitoneal location^[16]. The goal of endometriosis surgery is to obtain good long-term outcomes with regard to pain relief, recurrence rates, and fertility. Therefore, complete excision of all endometrial implants without compromising ovarian function is mandatory. Prevention of postoperative adhesion formation and improvement of quality of life are secondary aims. The association between different types of endometriotic lesions, such as peritoneal endometriosis, endometriomas,

or DE, should not influence surgical treatment, as radical removal of endometriosis resulting in functioning pelvic organs is of paramount importance. Multidisciplinary laparoscopic treatment has become the standard of care for treatment of bowel endometriosis in optimization of patients’ outcomes during their reproductive years^[17,18]. Non-randomized studies have shown that laparotomy and laparoscopy are equally effective in the treatment of endometriosis-associated pain^[19]. Because laparoscopy is usually associated with a better postoperative recovery, shorter hospital stay, and better cosmesis, it is preferred to open surgery. If the relevant experience with laparoscopy is not available, or when DE is suspected or diagnosed, it is recommended to refer the patient to an expert center that offers minimally invasive treatment in a multidisciplinary context^[20]. There is a general consensus that symptomatic endometriosis, especially DE, is best treated by a single laparoscopic operation in order to restore pelvic anatomy and to improve pain, quality of life, and fertility^[21,22]. Experienced surgical judgment by both gynecological and colorectal surgeons is essential to determine whether a bowel resection is required. In our center, a three-step surgical procedure was performed, and summarized below^[23]. In the first step, after placing temporary ureteric stents by the urologist, the

gynecological surgeon excises all visible endometriosis laparoscopically with a CO₂ laser to restore normal pelvic anatomy. In the second step, the urologist is consulted to evaluate and/or restore integrity of the ureters and the bladder. Finally, the colorectal surgeon evaluates the bowel. The decision to perform a laparoscopic segmental colectomy is taken under the following conditions: (1) large direct full-thickness trauma too extensive to be sutured; (2) extensive lesion to the bowel wall musculature in the absence of full-thickness damage but with impact on functionality; and (3) extensive lateral dissection compromising the bowel wall vascularization and/or innervation. In literature, controversy exists with regard to bowel resection. In our opinion, a patient-tailored approach is of utmost importance regarding the treatment of bowel endometriosis with emphasis on the patient's symptoms, radical removal of endometriosis, and bowel function. It is difficult to compare published data on outcome of the treatment of bowel endometriosis, because surgical techniques are not standardized. Moreover, bias with regard to selection of patients and surgical procedures is often present in observational studies reporting on the outcome of endometriosis surgery^[24]. Large prospective studies with standardized reporting of data will be necessary to evaluate surgical outcome in different centers^[24-26].

Rectovaginal DE

Rectovaginal endometriosis extends from the top of the posterior vaginal wall to the anterior rectal wall and to the uterosacral ligaments laterally. Laparoscopic resection is the treatment of choice for DE involving the rectovaginal septum, and several authors have reported good clinical outcomes with improvement in dysmenorrhea, dyspareunia, and chronic pelvic pain of 60%-92%, 70%-100%, and 60%-93%, respectively^[23,24,26-28]. However, to date, the debate with regard to different surgical techniques and the necessity of either a full-thickness disc rectal excision or a restorative resection is still ongoing^[24,25]. If there is no rectal wall invasion, laparoscopic resection can be done with few complications and good outcome^[29]. In our opinion, it is necessary to prepare the rectum with mechanical bowel preparation in case of rectal wall invasion. Subsequently, probes will be placed into both the uterus and the rectum to improve exposure. Pararectal spaces are opened and a circular incision around the nodule is made. It is dissected free from the uterosacral ligaments safeguarding the ureters. Then, a plane between the rectum and the lesion can be found using CO₂ laser dissection. Only after completion of the resection from the rectal wall, the nodule is dissected from the posterior vaginal wall. In case of vaginal wall invasion, the posterior fornix is excised and closely sutured. Superficial rectal lesions can be excised from the bowel using the "shaving" technique, but the integrity of the wall should be carefully assessed and checked with an air leak test^[30,31]. An experienced colorectal surgeon should judge on how to best restore rectal wall integrity by weighing two different surgical options, full-thickness disc excision

or partial rectal resection with reanastomosis. Moreover, in our center, radical excision of all endometriotic implants with clear margins is equally important in surgical decision-making. The decision to perform full-thickness disc excision or restorative bowel resection is mainly based on precise judgment by an experienced colorectal surgeon with expertise in radical endometriosis surgery. Because there are no guidelines whether or not to perform a resection, the decision is made on a case-by-case basis. Invasion of more than 50% of the bowel circumference, multiple nodules, or nodules larger than 3 cm are indications for a bowel resection^[32]. Thus, full-thickness disc excision is limited to the size of the lesion, depth of infiltration, and the location. The procedure fails to be microscopically complete in 40% of women due to active glandular endometrial foci deeply infiltrating the bowel wall^[32,33]. For a small nodule, full-thickness disc excision of the anterior rectal wall can be performed safely^[32-36]. However, the rectal wall should be well vascularized and innervated allowing a single layer transverse closure with separate sutures. If a restorative rectal resection is performed, care should be taken to preserve optimal bowel function. A side-to-end anastomosis or a colonic J pouch anastomosis is often necessary when part of the rectal ampulla is excised. In our center, a defunctioning loop ileostomy is performed only when there are sutures on the vagina, the rectum, and the ureter/bladder. An omentoplasty to protect the pelvic sutures is not performed routinely. Complications, such as anastomotic leakage or rectovaginal fistula, after bowel resection and anastomosis can occur^[37]. Different studies reported anastomotic related complications, such as leakage, pelvic abscess, and rectovaginal fistula. The incidence varied 1%-6%, at a mean rate of 4.7%^[38]. In papers reporting on bowel resection for endometriosis, the incidences of anastomotic leakages, abscesses, and rectovaginal fistulae were 1.5%, 0.3%, and 2.7%, respectively^[24]. In papers reporting on both bowel resection and full-thickness disc excision, the incidences for abovementioned complications were 0.7%, 0.3%, and 0.7%, respectively^[24]. Therefore, bowel resection leads to good operative outcomes with a low and acceptable major complication rate.

Rectosigmoid endometriosis

In case of bowel endometriosis infiltrating the sigmoid colon, a laparoscopic segmental colectomy may be required in order to obtain complete macroscopic clearance resulting in a good outcome regarding pain, quality of life, and infertility^[6,39-41]. In 1991, the first case of laparoscopic colectomy for bowel endometriosis was described^[42]. Since then, several groups have reported good results^[23,37,43-46]. However, a selective approach towards bowel resection is justified, because endometriosis is a benign condition and operative morbidity should be kept low. On the other hand, for sigmoidal endometriosis, a sigmoid resection or so-called high anterior resection is suggested considering it is technically impossible to perform a discoid excision on the sigmoid colon (Figure 3).

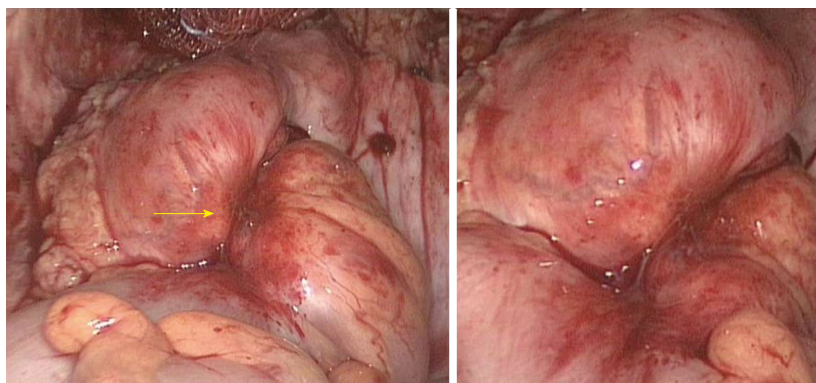


Figure 3 Laparoscopic view of bowel endometriosis invading the sigmoid colon (arrow). Same patient as in Figure 2B.

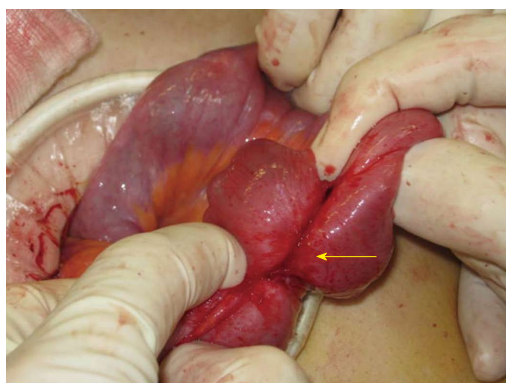


Figure 4 Small bowel adhesions secondary to invasion by endometriosis (arrow).

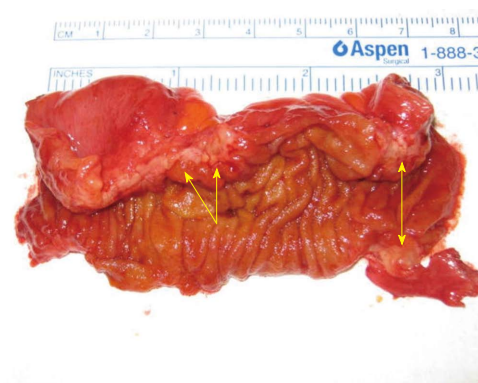


Figure 5 Segmental enterectomy (8 cm) for small bowel endometriosis. The bowel is cut open longitudinally. Note the two foci of non-transmural endometriosis (arrows) obliterating the bowel lumen.

A superior rectal artery sparing approach is performed with preservation of autonomic nerves, which has been shown to improve sexual and urological functioning^[47]. When neoplasia is a concern, an oncological segmental colectomy with lymphadenectomy should be performed. A randomized clinical trial comparing laparoscopically-assisted and open colorectal resection for endometriosis showed benefits on pain and postoperative complications in the laparoscopic group. Moreover, a laparoscopic approach offered a higher spontaneous pregnancy rate and similar improvement in quality of life compared to open surgery^[48]. Therefore, in a tailored approach of segmental colectomy for severe symptomatic endometriosis, access trauma to the abdomen should be minimal to allow fast recovery. We described a technique to extract the specimen transanally, so that a laparotomy can be avoided. This natural orifice specimen extraction colectomy (NOSE-colectomy) has good outcomes in patients requiring a colorectal resection for bowel endometriosis^[49]. Recently, a prospective cohort study comparing patients with and without bowel resection after CO₂ laser laparoscopic excision, observed good clinical outcomes and low major morbidity; anastomotic leakage was only 1%^[23].

Small bowel and appendiceal endometriosis

Small bowel or appendiceal involvement is rare and does not always cause symptoms. Usually, non-specific symp-

toms, such as recurrent pain and abdominal bloating, can accompany this type of endometriosis. However, acute small bowel obstruction due to fibrotic adhesions secondary to endometriosis has been described^[50]. Endometriosis can cause acute appendicitis with typical symptoms such as right iliac fossa pain, fever, nausea, and elevated white blood cell count. Appendiceal endometriosis can also act as a lead point leading to ileocecal invagination. Moreover, it can cause obstruction of the appendicular orifice with secondary mucocele formation. Appendiceal endometriosis is treated by appendectomy. The treatment of small bowel endometriosis depends on the size and location of the lesion. Small implants may be treated by wedge excision and sutured closure. If more than 50% of the bowel wall is affected or if the lesion is close to the ileocecal valve, a segmental small bowel resection or ileocecal resection may sometimes be performed (Figures 4 and 5)^[51].

Outcome of multidisciplinary surgery

Long-term outcome of radical endometriosis surgery evaluates three important parameters: (1) symptom control; (2) recurrence rate; and (3) pregnancy. Due to heterogeneous data reports on pain outcomes, it is difficult to compare results. Differences among reported results are mostly due to considerable variations in pain measure-

ment, method of evaluation, and length of follow-up. Overall, most of the studies show an improvement in pain, gynecological, and intestinal symptoms after bowel resection^[24]. Moreover, a recent study showed that radical but fertility sparing surgery, with or without bowel resection, has comparable and good psychological outcomes concerning depression levels, relationship satisfaction, and sexual function^[47]. Endometriosis recurrence rate, after bowel resection, has been reported in 4.7%-25% of cases after a follow-up period of more than two years^[24]. Meuleman and colleagues reported on three different cohorts of patients and showed a recurrence rate between 3% and 7% after CO₂ laser ablation and bowel resection. In a multidisciplinary setting, aiming at radical excision of endometriosis, recurrence rates can be low and results can be consistent over time^[23,41,52]. Observed post-operative pregnancy rates after bowel resection vary between 24% and 57%^[1,5,17,28,36,41,46,53,54]. A recent prospective cohort study showed similar pregnancy rates comparing a group of patients who had bowel resection to a group of patients without bowel resection, 50% *vs* 51%, respectively^[23]. The cumulative pregnancy rate was 44%, 58%, and 73% after 1, 2, and 3 years, respectively. This is in line with other retrospective studies reporting a cumulative pregnancy rate of 49% (at two years) and 52% (at 29 mo)^[41]. More recently, the endometriosis fertility index staging system was validated to predict non-assisted reproductive technology pregnancy after endometriosis surgery. This scoring system is the best available staging tool to counsel patients after a radical surgery about their fertility prognosis and eventual need for fertility treatment^[55,56]. Postoperative medical treatment is beyond the scope of this article; nevertheless, important considerations regarding active child wish and secondary prevention should be taken into account, during follow-up of patients who underwent a radical multidisciplinary endometriosis surgery. Although guidelines regarding the role of postoperative hormonal therapy exist, there is insufficient evidence showing significant benefit of hormonal therapy accompanying endometriosis surgery on the outcomes, specifically pain management^[20,57]. However, postoperative hormonal therapy could be prescribed for indications, such as contraception or secondary prevention^[20,23].

CONCLUSION

There is still a discussion about the optimal treatment of endometriosis involving the gastrointestinal tract. A standardized preoperative work-up for bowel endometriosis diagnosis is necessary. A multidisciplinary laparoscopic treatment, in an expert center, should be planned in advance to ensure adequate patient counseling. Laparoscopy is the preferred approach, as it is associated with less postoperative pain and faster recovery. Furthermore, fertility outcome is improved with a laparoscopic approach when bowel resection is required. An experienced colorectal surgeon should make a precise judgment on whether or not a full-thickness disc excision or bowel

resection is indicated. In our opinion, a patient-tailored approach is crucial and the least invasive radical option should be chosen. In the future, research should focus on long-term outcome improvements of the multidisciplinary treatment for bowel endometriosis with regard to symptoms, quality of life, cosmetic outcome, recurrence of endometriosis, and fertility.

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