

## Deep Infiltrative Endometriosis: A Review of Surgical Treatment Options

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**Abstract:** Deep infiltrative endometriosis (DIE) is defined as the presence of ectopic endometrial mucosa that infiltrates more than 5 mm of the peritoneum, in most cases accompanied by pain. Surgery is the treatment of choice in most cases. The aim of this review is to present the variety of surgical approaches to DIE. We performed a thorough MEDLINE search using the terms “(surgery OR surgical treatment OR surgical procedures OR surgical approach OR surgical technique) AND (deeply infiltra\* endometriosis OR deep endometriosis OR infiltrative endometriosis). A total of 17 articles were included in the present study. Depending on the site of the lesion, different surgical techniques can be used. Laparoscopy is the most used approach for different lesion sites. It can be combined with open surgery if needed. Another promising alternative to laparoscopy is robotic surgery. For lesions that are not very extensive ablation and shaving techniques can be performed.

**Keywords:** Deep Infiltrative Endometriosis, Peritoneal Pain, Surgical Treatment.

### Introduction

Endometriosis is defined as the presence of ectopic endometrial mucosa consisting of both endometrial stroma and glands [1]. It affects between 7 and 15% of the female population [2]. Deep infiltrative endometriosis (DIE) is a specific type of endometriosis that is characterized by an infiltration of the peritoneum for more than 5 mm. Several types of structures can be affected such as vagina, bladder, ureters, rectum and sigma [1]. In the pelvis, the left side and posterior compartment are more frequently affected [3]. The fat tissue tends to be spared by endometriosis [4]. Symptomatology varies according to the site of infiltration, pain being a main complain in most cases [3].

In order to assess DIE, various imaging techniques can be performed, but the gold standard procedure for diagnosis is still considered to be laparoscopy [5]. Based on the findings, DIE can be categorized using Enzian classification. This takes into account the site of

lesion: anterior compartment (vagina, rectovaginal septum), middle compartment (sacrouterine ligaments), posterior compartment (rectum, sigmoid) and dimension of lesions (grade 1 <1cm, grade 2-3cm, grade 3 > 3 cm). Other sites are noted separately: adenomyosis- FA, bladder-FB, intrinsic involvement of the ureter-FU, intestinal (above sigma)-FI, and other (e.g. diaphragm)-FO [6].

Treatment options include medical and surgical alternatives. When symptomatology cannot be improved noninvasively, surgery becomes the therapy of choice [3]. In the absence of treatment, quality of life is severely impaired as patient's symptomatology continues to aggravate. This could determine the onset of depression, anxiety or behavior alterations [7].

Therefore a quick diagnose and effective treatment are vital to the state of mind of the

patient. The aim of the surgical procedure is complete removal of the endometriosis. Depending on the site of DIE, surgery options can include resection of segments with anastomosis, or in favorable cases, shaving techniques. Treatment of DIE is complex and often requires a multidisciplinary team of surgeons and collaboration from various clinicians [5]. The aim of this review is to present the variety of surgical approaches to DIE, a challenging pathology.

A literature search was performed in PubMed using the terms “(surgery OR surgical treatment OR surgical procedures OR surgical approach OR surgical technique) AND (deeply infiltrat\* endometriosis OR deep endometriosis OR infiltrative endometriosis). The following filters were applied: Clinical Trial, Comparative Study, Controlled Clinical Trial, Multicenter Study, Observational Study, Randomized Controlled Trial, English. Only full text articles published in the last 10 years were taken into consideration. After careful examination, articles that were most relevant to the subject of our review were included, description of the surgical method adopted being the main criteria.

A total of 17 articles were selected to be described in our research. All surgical procedures described in the selected papers were carried out using general anesthesia. Depending on the affected structures, treatment might vary in means of surgical technique. Different management routes have been described for colorectal DIE. Laparoscopy is the method of choice, using a mini-laparotomy for exteriorization of structures after dissection, in some cases. Gynecologists and gastrointestinal surgeons have to cooperate for this type of treatment. Segmental resection, rectal nodule excision and rectal shaving represent alternatives depending on size and extension of lesions [8].

Laparoscopic procedure starts with pneumoperitoneum induction and exploration of the abdominal and pelvic space followed by excision of all endometriotic lesions. Dissection of the rectovaginal septum is performed, to emphasize the rectal lesion and liberate the rectum. For the segmental resection of the recto-sigmoid area (in cases of full wall thickness lesions), the excision is made and a semicircular stapler or an end-to-end stapler can be used for

the final anastomosis, through a transanal approach. The resected segments of the recto-sigmoid are removed through a Pfannenstiel-Kerr incision [9-11]. In cases of DIE that comprise the whole vagina wall, a vaginal approach is preferred. Excision of the vaginal nodules using a stapler and exteriorization of the resected intestinal segments are accomplished, with final suturing of the vaginal defect and transanal stapler anastomosis of the colorectal segment [12].

To verify the quality of the rectal anastomoses, an air-fluid test can be performed. This procedure is performed by introducing saline solution inside the pelvic cavity and by insufflating air inside the rectum. If bubbles appear inside the pelvic cavity, the suture is not holding perfectly and more stitches should be placed [12-13].

Regarding lesions that do not affect the whole rectal wall thickness, shaving can be used as a method of resection, without having to open the lumen. It can be well performed also in laparoscopic manner. The subperitoneal space is exposed and dissection along the lateral sides of the rectum is done, exposing the lesions in the rectovaginal space. With the use of an endoscope, with high magnification, lesions are carefully removed from the rectal wall by shaving. This can be performed using a device comprising of scalpels and scissors, or by plasma ablation [14].

To be noted is that the rectum is not necessarily involved in DIE. Angioli et al. described in 2014 the approach to DIE comprising the posterior vaginal wall with little involvement of the rectovaginal septum. A combined approach is necessary, vaginal and laparoscopic, in 3 steps, the first and last being done in vaginal approach. Procedure starts by examination of the vagina.

The endometriotic nodules are emphasized by pulling the cervix anteriorly. An incision in form of a half-circle is made around the lesion, to permit removal from the anterior rectal wall. Next, using laparoscopy, a complete assessment of the abdominal and pelvic cavity is made for other possible endometriotic lesions. Dissection of the

endometriosis from the rectovaginal septum is completed. Using the vaginal approach again, the nodule is fully excised and the vagina is sutured [15].

A technique for sparing the inferior hypogastric nerves was described in the literature. Lesions of the mentioned nerves can represent a cause of urinary retention and sexual dysfunctions. Procedure is started by identifying the ureter where it crosses the common iliac artery. Dissecting toward the promontory, the superior hypogastric plexus can be identified, in the presacral space. The inferior hypogastric nerve descends from the plexus, along the mesorectum and the ureter. The nerve is removed from the uterosacral ligament. Also, identification of the inferior hypogastric plexus is made, laterally to the rectum. It comprises the inferior hypogastric nerve and the splanchnic nerves (S2-S4 roots of the sacral plexus). Resection of the endometriotic lesions can be performed after this step [16-18].

Another structure that can be a target of endometriosis is the ureter. Soriano et al. describes his technique: a multidisciplinary team of urologists and gynecologists performed laparoscopic interventions comprising of ureterolysis or ureter sectioning and reimplantation. During examination, after inducing pneumoperitoneum, size of lesion, extension to the surrounding structures and state of the ureter are assessed. When the muscular layer is affected, ureterolysis is no longer feasible and a resection is necessary to completely remove the endometriotic lesion.

In this case the reimplantation of the ureter into the bladder is necessary. In the majority of time it can be completed under laparoscopy, but certain cases require a laparotomy. Pre-operatively, accurate assessment of the type of ureteral lesion (intrinsic or extrinsic) is hard to be accomplished. It would be expected that patients with an intrinsic lesion present hydronephrosis, but it is not always the case, many patients being asymptomatic from this point of view [19].

Assessment of the bladder lesions is necessary before reimplantation of the ureters. Full excision or cystectomy can be alternatives for treatment, during the same surgery [20]. For approach of the bladder, dissection in medial and lateral

paravesical spaces, retropubic space, vesicoureteral ligament is made in order to be able to resect the infiltration. This allows also for resection of ureteral lesions. The ureter is afterwards reimplanted in the remaining bladder, if long enough. If this is not the case, the bladder is attached to the psoas muscle followed by ureter implantation. In bilateral ureteral dissections, a v-shaped cystoplasty is made [21].

For ovarian DIE, treatment alternatives include excision during laparoscopic surgery or through robotic single-site surgery using daVinci® system. Both procedures follow the same steps: inspection of the peritoneal cavity, dissection of adhesions and extraction of the ovarian cysts. Using robotic surgery, the operator is able approach lesions closer, even in spaces between structures that is harder to reach. Excisions are easier to perform with the instruments of the robot, allowing resection of nodules of all sizes. Another benefit to the surgeon is the more comfortable process of operating [22].

Another location where endometriosis can be identified is the diaphragmatic level. It can be encountered in up to 25% of patients with extrapelvic disease. It might present as asymptomatic, but some women may present pain in the upper body or in some cases, hemothorax or pneumothorax when pleura is involved. Laparoscopic surgery represents the first choice for treatment. For right-sided DIE, incision of the peritoneum along the costal border is made and traction is performed to the left side.

Retroperitoneum is incised in order to liberate the liver, with continuation along the right kidney and Gerota's fascia. The anterior dissection is advanced until it meets the posterior one. Hepatic veins are exposed by further turning the peritoneum posteriorly. At this stage the liver is completely shifted towards the left side in order to free the diaphragm. The next step consists in excision of the diaphragmatic endometriotic nodule, together with the peritoneal lesions. The thoracic cavity should also be inspected laparoscopically to identify any possible endometriotic lesions. A running suture is used for closing the diaphragm defect [23].

Apart from the methods mentioned, ablation has also been tested for treatment of endometriotic lesions. Healey et al. have compared ablation to excision in their study. Patients diagnosed with endometriotic lesions were included, not taking into consideration the following sites: bladder, ureters, and bowel. Ablation was carried out using monopolar or bipolar diathermy. At 5 years

post-operatively women which underwent ablation necessitated more pharmacological therapy for control of symptomatology (pain, dyspareunia). A possible explanation could be the lack of complete ablation of the lesions [24]. A summarization of the techniques described can be found in table 1.

**Table-1: Summarization of techniques currently used for DIE [8-24]**

Technique	Site of lesion	Particularities
Laparoscopy	Colorectal, rectovaginal septum, bladder, ureter, ovarian, diaphragm	Allows full excision of lesion with maximum precision and small risk of recurrence
Combined laparoscopic with vaginal approach	Vagina	
Shaving	Colorectal	Minimal damage Less precise, lesion might not be dissected completely
Robotic surgery	Ovarian	Better vision and dissection of lesions Higher costs
Ablation	Various sites	Less invasive Lesion might not be dissected completely
Laparotomy	Same as in laparoscopy, used in the rare cases when laparoscopy is not sufficient	Invasive Longer time for recovery and longer hospitalization

DIE is a pathology with a high grade of complexity, as it can affect many organs and produce various symptomatology. Surgical treatment is the only curative option but only when performed correctly as incomplete removal of lesions may cause recurrences. Because of the many possibilities of iatrogenic lesioning of other structures, a definite surgical protocol would be hard to constitute, but rather protocols regarding each organ individually are more feasible.

As the pelvis, the area where endometriosis occurs most frequently, comprises many structures, especially nerves, it is necessary to have a good understanding of the procedure and a certain level of experience. Nerve sparing techniques are of outer importance, as even small lesions can turn a curative surgery into the starting point of another complication that requires treatment.

Up to this point techniques resembling full excision of the endometriotic lesions have proven to have better outcomes in long-term follow ups. Regarding ablation and shaving, it would be of use to the community of surgeons to have more research performed in this area. Although not malignant, DIE can require in some cases radical treatments such as cystectomy, ovariectomy or bowel resections.

Therefore, improvements on such techniques could mean a less challenging treatment and a more comfortable attitude for both the surgeon and the patient. Another characteristic of DIE treatment is the need for a multidisciplinary team of surgeon to collaborate as structures affected are not always from the gynecological field. In some countries this is still an emerging practice.

## Conclusion

DIE is a complex disease which demands an elaborate treatment. For each affected organ there is a specific approach of treatment. More

attention should be paid to the management of endometriosis, as it requires a multidisciplinary team in order to be treated correctly.

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