Laparoscopic rectum surgery for endometriosis

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1. Preparation of the patient

Unlike in the past, we no longer perform a bowel lavage even when a rectum resection/anastomosis must be performed. The patient takes two or four bisacodyl tablets depending from her weight the day before surgery. The classical bowel lavage with few liters of fluid has been abandoned.

2. The operation


the rectum about 5-7cm upwards from the linea dentata.

2.1 Part 1: The vaginal part

After proper desinfection of the vagina, the posterior fornix of the vagina is exposed by two Breisky specula and the cervix is pulled ventrally by two tenacula. The vagina as well as the posterior cervix are infiltrated with about 5-10ml lidocaine hydrochloride 1% with epinephrine. The vasoconstrictor effect of the epinephrine is of great importance as dissection of the rectovaginal septum and the Denonvillier fascia requires optimal vision and bloodfree dissection.

After waiting 2-3 minutes until the injection puncture has stopped bleeding, the vagina is incised around the endometriotic nodule with enough free margin – direct digital palpation allows for optimal control of the limit between the lesion and the surrounding healthy tissue.

The lesion is transected from the cervix using monopolar needle upwards over 2-3cm. If fotodocumentation from previous surgery demonstrates than no intestinal anses are attached to the cervix and/or pouch of Douglas, dissection of the lesion from the cervix is carried on upwards with a scissors and the pouch of Douglas is opened.
This dissection saves a lot of time during the further laparoscopic part of the surgical procedure as laparoscopic dissection of the lesion from the cervix is not easy: when this dissection is performed ventrally, a large resection of the cervix is performed and when it is performed dorsally, damage to the bowel can occur.

Dissection the vaginal way permits the surgeon to follow the dorsal wall of the cervix and to optimally control potential bleeding. If no documentation can prove that the pouch of Douglas is free, the dissection of the posterior cervix is stopped before opening the pouch of Douglas in order to avoid injury of potential attached intestinal anses.

The dissection of the cervix is performed lateral to the rectovaginal ligament and is stopped there in order not to endanger the ureter.

The dissection of the rest of the vagina and of the rectovaginal space is performed with a scissors. After placing a finger in the rectum, the Denonvilliers fascia just caudal of the lesion is exposed and divided.

The Denonvilliers is an extremely important anatomical structure: this fascia builds an anatomical fence against infiltration by endometriosis. In many cases, dissection of the space dorsal from it shows an infiltration of the fascia without infiltration of the pre-rectal space and bowel resection is not required.

This dissection the vaginal way saves time as it is much easier than the laparoscopic way: concommittant digital rectal palpation allows the surgeon to knows exactly the limit of the rectum and to control every small bleeding which could affect the optimal vision and exposure of the dissection area.

The rectovaginal space caudal of the nodule is expanded by blunt dissection and exposure of the rectal wall where the transection will be performed the laparoscopic way. Lateral of the rectum, both pararectal spaces are dissected and extended dorsally to the coccygeal bone and as close as possible to the rectal wall.

The insertion of a finger in the rectum allows the dissection of both pararectal spaces close to rectum in order to open this space medial of the pelvic splanchnic nerves but with a lower risk of lesion to the rectum itself.

The excised portion of the vagina is left on the rectum and the vagina is sutured to the posterior cervix by separated sutures.

No manipulator of the uterus is used as manipulation would pull out the sututres in the vagina

In a situation where there is anastomosis leakage the opening of the vagina is the best natural drainage for early diagnosis before the patient develops pelveo-peritonitis. In the situation where there is postoperative hematome of the pelvis, removal of one or two sutures allows spontaneous flow and voiding of the blood through the vagina.
2.2 Part 2: The laparoscopic „en-bloc-dissection“

The patient is placed in the Trendelenburg position with straight legs for the laparoscopic part of the procedure as no further rectovaginal examination or uterine manipulation is required during this phase of the procedure. A 10-mm trocar is put through the umbilicus to hold the laparoscope with the mounted camera. Three further 5-mm trocars are placed in the lower abdomen, with the lateral trocars positioned laterally to the epigastric vessels. For dissection, just a scissors, two forceps for dissection and a 3-mm bipolar coagulation forceps are applied.

The principle of our dissection is not primarily the removal of the nodule out of the surrounding tissue but the exposure of the surrounding anatomical structure. During the excision of a nodule out of the rectovaginal septum, some neural structures have to be resected as the rectovaginal ligament and, in fact, the cranial part of the inferior hypogastric plexus are mainly involved. For reduction of the postoperative functional morbidity, it is impossible to dissect and save the nerve at the level of the nodule. At the pelvic wall the anatomy is respected and normal, at least on one side. It is easier to expose the parasympathetic nerves just out of the sacral roots (S2-S3) and then dissect them by following them. The resection of the nodule or of the rectum is quite easy as the structures have been exposed and the rectosigmoid is free.

On the right side, the retroperitoneal space is opened at the promontorium between the sigmoid and the right ureter. The right pararectal and retosigmoido-rectal spaces are extended by blunt dissection directly along the sacral and more caudally to the coccygeal bone strictly on the medial line. An identical dissection is performed on the opposite side medial of the left ureter and unification with the right dissection is performed dorsal of the recto-sigmoid.

Both pararectal gutters are transected caudal of the level of both rectovaginal ligaments while both ureters are dissected to to the level of their crossings with the uterine arteries. The recto-sigmoid is completely free from the pelvic floor.

This dissection is continued lateraly and ventrally in direction of the dorsal aspect of the cardinal ligament by absolute smooth and gentle dissection. The third sacral root is identified lateral of the fascia hypogastric sacralis. Confirmation is gained by using laparoscopic electrostimulation: The S3 nerves are responsible for levator movement or bellow movement of the peritoneum. Visually this is apparent as a deepening and flattening of the buttock groove as well as a plantar flexion of the large toe and to a lesser extent of the smaller toes. Identification of S3 is performed because S3 and S4 are the roots responsible for bladder function in man. By maximal use of the magnification of the endoscope, dissection of the S3 is extended ventrally and the parasympathetic nerves sprouting medio-caudally out of this root are identified and their function is confirmed.
by using laparoscopic neuronavigation - LANN (Possover M, Rhiem K. Influence of „parasympathetic-nerve-sparing“ technique in laparoscopic radical pelvic surgery for cervical cancer and for deep infiltrating endometriosis on postoperative bladder dysfunction. in press - Possover M, Rhiem K, Chiantera V. The „Laparoscopic Neuro-Navigation“ – LANN: from a new field of laparoscopic surgery to a functionnal cartography of the pelvic autonomous neurosystem. In press ). The nerves are followed ventraly by extremely gentle dissection to their anastomosis with the homolateral inferior hypogastric plexus. If it is possible – depending on the extent of the endometriosis - this dissection of the parasympathetic is performed on both sides.

It is normally not feasarable to preserve the cranial part of the inferior hypogastric plexus as endometrioseis usually infiltrates this part of the rectovaginal ligament. However, the parasympathetic nerves anastomosis to this pelvic plexus much more caudally and could be mostly – at last on one side – preserved. The postoperative functional morbidity is generally not due to infiltration or destruction of these nerves by endometriosis, but due to the transection of them during the dissection.

The dissection is continued dorsally and the fascia of Waldeyer is opened just caudal of the endometriotic nodule.

The both pararectal spaces that have been opened vaginally are exposed.

Finally, transection of the rest of the recto-cervico-vaginal ligament is performed close to the cervix allowing development of the rectovaginal space caudal of the lesion that had been vaginally opened.

The endometriotic nodule is completely mobilized en bloc and remains on the anterior wall of the rectum covered by the excised portion of the vagina. The rectum below the lesion is free and mobile enough for this transection. The middle 5mm suprapubic trocar is removed and is replaced by a 12-mm trocar and the rectum is transected caudal of the endometriotic lesion using a laparoscopic stapling device type EndoGIA.

Complete laparoscopic mobilization of the recto-sigmoid allows extraction of its cephalad portion through a suprapubic minilaparotomy 2-3cm wide. If mobilization of the pelvic connective tissue is not sufficient, the mesosigmoid is mobilized by incision of the peritoneum in the left paracolic gutter and the left colonic flexure.

Particular attention is paid that there is no lesion of the ureter.

To check if the deep anterior colorectal anastomosis is free of tension, the endometriotic lesion is grasped and tracted to the suprapubic trocar. If there is tension caused by this manoeuvre, there is a risk of tension on the anastomosis and a transection of the superior rectal artery is required.

A transection of the inferior mesenteric artery or the sigmoidal artery is normally not necessary as in endometriosis of the rectovaginal space, the tension on the anastomose is normally not due to the shortness of the rectosigmoid but to the tension of the meso-recto-sigmoid. Transection of the superior rectal artery can be performed as the blood
supply to the terminal rectum is assured by the arcade of Drummond, the prolongation of the arcus of Riolani and consequently of the arteria colica sinistra.

### 2.3. Part 3: The deep anterior colo-rectal anastomose

After removal of the 12-mm trocar, this incision is enlarged to a length of about 2-3 cm. Complete laparoscopic mobilization of the rectosigmoid allows extraction of the cephalad portion of the rectum through this suprapublic minilaparotomy. The best area for the bowel transection cranial to the endometriotic lesion is selected by extra-abdominal inspection and palpation. This transection is performed with a purse-string suture.

After dilatation of the bowel, the tilt-top anvil of a transanal circular stapler is introduced and the purse-string suture is knotted.

In order to reduce the risk of anastomose stenose, the size of the circular stapler have to be chosen as large as possible. At the level of the lower rectum, size 33/34 or at least 31 can usually be used.

The bowel is reintroduced into the abdomen and the minilaparotomy incision is closed.

The stapler is inserted transanally into the rectal stump and the connector is pushed just laterally to the existing staple line.

The transfixion of the rectal stump does not have to be performed through the staple line as risk of its deconnection is high. The transfixion does not have to be performed more than 2 cm away from this staple line (figure a): superposition of both staple lines expose the anastomosis to an increased risk of leakage (figure b). When a bridge of tissue has to be respected between both staple lines, the risk of ischemy of this tissue is extremely high as is the risk of a fistel (figure c).

**Figure a**  **Figure b**  **Figure c**

Transanal colorectal anastomosis is performed by connecting the stapling device with the anvil and firing the stapler. The anastomosis is controlled laparoscopically by transanal air insufflation while compressing the sigmoid to confirm integrity of the anastomosis.

At the end of the procedure a drainage Chariere 16-18 is placed in the plevis but direct contact with the anastomose must to be avoided. When a rectum resection with deep anterior colorectal anastomosis less than 6 cm from the linea dentata is performed –even with the „parasympathetic-nerves-sparing technique“ - a suprapubic catheter is placed at the end of the procedure for two reasons:

- Firstly, to avoid filling of the bladder before spontaneous defecation which could disturb the healing process of the deep anterior colorectal anastomosis.
Secondly, as dissection of the nerve, even by gentle dissection, can produce a neurapraxy for a few days and consequently temporary bladder atony.

3. The postoperative management

During the first 6 days after the procedure no rectovaginal manipulation has to be performed and oral carence is respected in order not to stimulate bowel movement. The patient receives an infusion programm of about 2.5l per day and 1/2l of liquid is permitted.

In order to make the postoperative follow-up as safe as possible, we drain the bladder for the first 6 postoperative days where the risk of anastomosis leakage is the highest and the bladder training begins after spontaneous defecation generally between the 6th and the 8th postoperative day. The suprapubic catheter is removed when the postmictional resturine is measured to be constantly less than 70ml.

After spontan defecation, the patient is allowed to resume eating, starting with a light diet.

4. The laparoscopic assisted vaginal „parasympathetic-nerve-sparing“ technique – why this technique?

Radical pelvic surgery is usually restricted to malignat diseases. Thus retroperitoneal dissection with bowel resection and anastomosis might appear too radical, with a high risk of postoperative morbidity as anastomotic leakage and functionnal postoperative morbidity as bladder atony.

4.1. Why rectum resection/anastomosis?

Submucosal excision of bowel endometriosis can only be used with limited lesions and in sano resection is uncertain as deep endometriosis of the bowel is characterized by multifocal disease in the musculari of the intestinal wall. This dissection is tedious and time-consuming in large lesions, intraoperative bowel perforation or extended coagulation with ischemia of the remaining wall can occur, and the risk of postoperative bowel perforation/fistel is high. Thus, with endometriosis infiltrating an area of more than 3cm in diameter of the rectum wall, resection with anastomotis is safer than local excision.

4.2. Why laparoscopic assisted vaginal technique?

For treatment of rectovaginal deep endometriosis, several surgical approaches have been described (Tuson JR, Everett WG. A retrospective study of colostomies, leaks and strictures after colorectal anastomosis. Int J Colorectal Dis 1990;5:44-8 - Candiani GB, Vercellini P, Fedele L, Roviaro G, Rebuffat C, Trespidi L. Conservative surgical treatment of rectovaginal septum endometriosis. J Gynecol Surg 1992;8:177-82 - Nezhat C, Nezhat F, Pennington E. Laposcopic treatment of infiltrative rectosigmoid colon and rectovaginal septum endometriosis by the technique of

- Ureter and uterine artery must be dissected from surrounding tissue because endometriosis infiltrates the tissue along the uterine artery quite frequently (Candiani GB, Vercellini P, Fedele L, Roviaro G, Rebuffat C, Trespidi L. Conservative surgical treatment of rectovaginal septum endometriosis. J Gynecol Surg 1992;8:177-82)

- Digital palpation of the tissue – first of all the vagina, the cervix and the rectum – is mandatory to select the optimal resection plane for complete removal of all endometriotic tissue.

Tabelle 1 shows advantage and disadvantages of the different techniques. All „one-way“ approaches have their own advantages and disadvantages and no one of these approaches presents all required advantages together. With our „three-way“ approach we have all advantages together:

1. Vaginal part:

- transvaginal identification of adequate levels of the caudal resection margins becomes possible by direct digital exploration of the rectovaginal and the pararectal spaces

- since the Denonvillier is a barrier to the dorsal progression of the endometriosis to the rectum, dissection dorsal of this fascia can be performed with optimal view and saves dissection of the rectum. If a lesion of the lower rectum appears or if a circular rectum excision has to be performed, suture can be performed extraperitoneally and under optimal conditions.

- dissection of the rectum at the level where the stapler transection will be performed as close as possible to the rectal wall to avoid lesion of the splanchnic pelvic nerves.

2. Laparoscopic part:

- all intrapelvic lesions could be removed and further urological or intestinal procedure can be associated

- laparoscopic magnification and the possibility of dissection in all parts of the retroperitoneal space constitute the base for the „parasympathetic-nerve-sparing“ technique
retroperitoneal approach and mobilisation of the lesion en-bloc with the rectosigmoide make the procedure quite bloodfree and time-sparing

3. Minilaparotomy:

- Eventeration of the rectosigmoid through a minilaparotomy allows in sano resection of the infiltrated segment by direct palpation and inspection of the bowel wall and its lumen.
- Digital palpation of the pelvis and part of the abdomen is possible through minilaparotomy
- When further partial bladder resection or ureter-resection is performed by laparoscopy, a suture of the bladder or uretero-cystoneostomy can be performed more easily and timesaving through minilaparotomy as by laparoscopy.

Our technique is to differentiated from all the other described techniques as we do not dissecte the endometriotic nodule out of the surrounding tissue but we first dissect the retroperitoneal space at the pelvic wall where the anatomy is normal in order to expose all anatomical structures, primarily the parasympathetic nerves

4.3. Why „parasympathetic-nervsparing-technique“?

In our consecutive patients following „parasympathetic-nervsparing“ radical surgery for deep infiltrating endometriosis (n=91), the suprapubic catheter could removed on average after 2 days of bladder training. It was always possible to intraoperatively preserve at least on one side of the parasympathetic nerves. All these patients were able to to void their bladders normally, spontaneously and continuously. Our technique of laparoscopic assisted vaginal nerve-sparing resection of the rectum with deep anterior colorectal anastomosis in extended endometriosis is based on the principle of primary systematic identification, dissection and preservation of the parasympathetic nerves before dissection of the endometriotic nodule as exposure of the nerves close to the nodule is technically not possible: The only chance of identifying the pelvic parasympathetic nerves is close to the pelvic wall where the tissue is normally not involved by endometriosis and consequently the anatomy has remained normal. Our actual data show a significant lower rate of lower bladder dysfunction after deep anterior colorectal anastomosis16 even in comparison to the nerves-sparing mesorectal excision technique in which this rate is about 20-40%17. To date we have performed laparoscopic rectum resection with deep anterior colorectal anastomosis on 154 consecutive patients. No patient in our series has to use self-catheterisation but in comparison to our first series18, the mean duration of bladder training was reduced from 11,3 to two days. The preservation of the sympathetic part of the inferior hypogastric plexus is mostly impossible as endometriosis infiltrates the rectovaginal space and generally lateral of the pelvic plexus itself. The risk of destruction of the vesical splanchnic nerves occurs first of all by the transection of the rectovaginal ligament latero-ventral of the rectum. When the rectum is mobilised dorsal of the Waldeyer fascia and its mobilisation continues laterally following this fascia and more ventral to the fascia of
Denonvilliers, the parasympathetic nerves for the bladder are nearly always destroyed. When we ventrally dissected the parasympathetic nerves, we systematically found that these nerves transfix this fascia in its dorso-lateral portion. Thus dissection of the rectum at a level deeper than 6cm from the linea dentata has to be performed medial of the perirectal fascia and as close as possible to the rectum: this is much easier when the dissection of the pararectal spaces has been previously performed the vaginal way by simultaneous endorectal palpation.

These techniques of exposure of the autonomous pelvic nerve can be performed by laparotomy as well as by laparoscopy, but their exposure dorsal to the rectum is much easier by laparoscopy due to the magnification of the endoscopic optic and due to the possibility of good access to all different parts of the pelvis even in the depth of the retrorectal space. The „nerve-sparing techniques“ have to change the surgical philosophy of the surgeon and oblige us to change our surgical technique from „macrosurgery“ with clamp/section to the technique of minute and bloodfree dissection. This new knowledge about the functional pelvic neuroanatomy not only changes our surgical concept, but also the classical nomenclature of „cardinal ligament“ and „sacrouterine ligament“ which is no longer acceptable as these structures do not exist as ligaments: the classical concept of pelvic support by ligaments has to be reviewed.

Tabelle 1

**Surgical Approach Advantages Disadvantages**

**Vaginal approach** - resection of the vagina adapted to the size of the lesion - no dissection of the uterine arteries and of the ureters
- optimal dissection of the lower part of the lesion - no approach to the entire pelvic cavity
- optimal dissection of the space dorsal of the - no mobilisation of the recto-sigmoid fascia of Denonvillier - risk of intestinal lesion in frozen pelvis
- optimal resection of the nodule to the dorsal cervix - partial rectum resection depends on the view and the technical - time-saving approach

**Laparoscopic approach** - optimal view of the entire pelvic cavity - difficult to find the right plane to the dorsal cervix
- optimal access to all the different regions of the pelvis - difficulties in adaptation of the colpectomy to the exact infiltration
- possibility of „nerve-sparing“ technique - time consuming
- blood-free / less adhesions
- optimal mobilisation of the recto-sigmoid

**Laparotomic approach** - digital palpation of the tissue - techniques of macrosurgery
- difficulties of access to the deepness of the pelvis by preservation of the uterus
- postoperative adhesions
- difficulties of view and dissection dorsally to the rectum