Chapter 12
Minimally Invasive Surgery for Rectal Prolapse: Laparoscopic Procedures

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Introduction

Surgical treatment of external rectal prolapse, internal intussusception (or internal rectal prolapse), and rectocele is still a challenging clinical problem in colorectal surgery [1, 2]. These conditions may be associated with various pelvic floor disorders, including motility and morphological/functional disorders, ranging from constipation to fecal incontinence, thus significantly affecting the patients' quality of life [3, 4]. A large variety of surgical procedures exists. The literature offers abundant publications, the main problem for an informed decision on the perfect surgical technique being an often large variability of patients' selection, diagnostic assessment and variation within the same surgical technique and materials. As a consequence, the colorectal surgeon still lacks a standardized diagnostic assessment as well as a clear ideal surgical technique [5]. Perineal procedures, such as Delorme's or perineal rectosigmoidectomy or stapled transanal rectal prolapse resection, are indicated for elderly and frail patients, who are not fit for an intervention under general anesthesia, but they have poor efficacy in terms of functional outcomes and recurrence, which may be up to 26 % [6], and also an increasing risk for postoperative incontinence [7]. Abdominal procedures, on the other side, either open or laparoscopic, employing rectal mobilization and fixation, colonic resection or a combination of both, show lower recurrence rates and better functional results, but may cause postoperative worsening of constipation, mostly due to the full rectal mobilization and the consequent possible autonomic nerve injury, which is responsible for dysmotility and impaired evacuation [8]. Laparoscopic ventral mesh recto(colpo)pexy has been introduced in order to obtain good results in terms of

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functional outcome of the abdominal procedures while avoiding postoperative constipation and incontinence, offering the advantages of anterolateral mobilization, mesh repair and of a laparoscopic approach compared to an open one [9].

In 2000 Brazzelli et al. published a Cochrane review of ten trials about surgical treatment of rectal prolapse, either retrospective or prospective. Its aim was to demonstrate the advantage of either abdominal or perineal prolapse procedures, to clarify which technique of rectopexy was the best, whether a laparoscopic approach was better compared to the open, and whether a resection should be added to the procedure to overcome the risk of ʿex novoʾ postoperative constipation [7]. Only two prospective randomized trials analyzed the short-term outcomes after open and laparoscopic rectopexy, demonstrating the superiority of a laparoscopic approach in terms of a shorter hospital stay, reduced postoperative pain and global morbidity, and faster return of gut function, along with high satisfaction of the patients with aesthetic results. On the other hand, operative time is longer in the laparoscopic group [10–12]. Long-term results regarding the same series of patients, however, showed no significant differences in functional outcomes between the laparoscopic and open approach. In fact, recurrence rates, continence, and constipation scores were almost the same in the two groups [13].

Another meta-analysis on laparoscopic versus open rectopexy, published in 2005, highlighted other outcomes of interest: blood loss and the need for opiates were less in the laparoscopic series, as well as the costs, although the expense for the surgical materials was higher. This could be related to the lower morbidity of the lap approach, which consequently has a minor burden on the hospital balance [14]. Nonetheless, the reduced hospital stay has a great effect in minimizing the negative psychological effects of hospitalization.

A more recent meta-analysis published by our group in 2012 considered eight comparative studies, consisting of 467 patients, of which 275 were operated using an open approach and 192 using a laparoscopic one. The analysis of the data demonstrated once again that there were no statistically significant differences between the two techniques in terms of longer-term results regarding constipation and incontinence as well as recurrence rates. This article adds weight to the previous meta-analysis and Cochrane review cited above and demonstrates that a laparoscopic approach provides good outcomes and a comparative risk of recurrence compared to open surgery, with all the advantages related to laparoscopic surgery, especially in terms of reduced postoperative pain, shorter hospital stay, and a shorter convalescence period [15]. Moreover, Magruder and colleagues demonstrated in 2013 that surgical site infection rates in a series of 685 patients were lower after laparoscopic procedures compared to open ones [16].

In 2011 Wijffels and colleagues published a paper about Laparoscopic Ventral Rectopexy (LVR) in elderly patients. They demonstrated the feasibility and safety of this type of laparoscopic surgery in elderly patients with a good functional outcome, zero mortality, a very low-morbidity (only one major complication: an intraoperative inferior myocardial infarction successfully paced), and low recurrence rates (3 %). Many surgeons believe the perineal approach to be superior to the

laparoscopic in the elderly due to its anesthetic requirements and better tolerance of spinal anesthesia. However, it is to be considered that the prone position, frequently used in the perineal approaches, may cause circulatory abnormalities requiring intravenous fluid boluses. Spinal anesthesia is only practicable with the patient in lithotomy position, due to its uncontrolled spread of local anesthetic with the prone position [17].

The aim of this chapter is to describe the different laparoscopic approaches available for the treatment of rectal prolapse and to highlight the advantages of laparoscopic procedures in comparison to open ones.

Current Laparoscopic Procedures for the Treatment of Rectal Prolapse

Laparoscopic abdominal procedures are all characterized by rectal mobilization and fixation, but they are different in terms of the extent of rectal mobilization and method of fixation. The different techniques may involve rectopexy, with or without sigmoid resection, with ventral or posterior techniques, with the use of a mesh to fix the rectum to the sacrum or not. Finally, the mesh can be synthetic or biological and absorbable or non-absorbable. We will describe in this chapter the currently used procedures.

Suture Rectopexy

This technique was first described by Cutait in 1959 [18]. In this procedure the rectum and the rectosigmoid are entirely mobilized as low as possible to the levator ani muscle and subsequently the rectum is secured to the sacrum or the presacral fascia. The laparoscopic approach follows the same principles of the open technique.

The patient is positioned in a modified lithotomy position and bilateral ports are needed. The sigmoid colon and rectum are firstly controlled for redundancy. The peritoneal reflection is incised and a posterolateral rectal dissection is performed, with a deep posterior mobilization through the avascular plane, avoiding hypogastric nerve injuries and bleeding. The ureters are identified and preserved during the lateral dissection. After the full rectal mobilization the rectum is sutured to the sacral promontory or the presacral fascia using interrupted non-absorbable sutures or staples [19]. Suture rectopexy is probably the most diffuse and simple abdominal approach, provided colonic resection is not added to the procedure. Blatchford et al. reported a single recurrence in a series of 43 patients with a follow-up longer than 2 years [20]. In a large series of 150 patients undergoing laparoscopic rectopexy, the conversion rate was about 5 % and main reasons for conversion were bowel injury, poor visibility, and adhesions in four patients [21].

Constipation and anal incontinence are two associated problems with complete prolapse of the rectum. Patients with complete rectal prolapse have markedly impaired rectal adaptation to distension which may contribute to anal incontinence and consequently, more than half of the patients with rectal prolapse have coexisting incontinence [22].

In a series of 72 patients with a median follow-up of 48 months, 34 % experienced postoperative constipation while recurrence was observed in 9 % of cases [23]. Constipation is a common problem after rectopexy, particularly so after posterior mesh rectopexy . Studies have demonstrated that constipation increased from 10 to 47 % and suggested a link with denervating the left colon and rectum with possible kinking at the rectosigmoid junction by a redundant, unresected sigmoid colon prolapsing into the pouch of Douglas [24]. This may be particularly so because the lateral ligaments containing the parasympathetic inflow to the left colon, may be cut during mobilization. At least two studies have demonstrated a higher incidence of constipation with significant changes in rectal sensation when lateral ligaments are divided as compared to sparing of the lateral ligaments [25, 26]. Suture rectopexy has been shown to be as effective as mesh rectopexy in preventing recurrence, but it avoids the problems of postoperative sepsis and increased constipation [27].

Frykman-Goldberg Procedure

In 1969 Frykman and Goldberg described a series of 80 cases and published the classic description of their procedure: the Frykman-Goldberg resection-rectopexy with the aim to avoid postoperative constipation. It consists of a rectopexy combined with a sigmoidectomy, in order to avoid postoperative constipation [28]. Several reports have confirmed that this resection-rectopexy mitigates postoperative constipation resolving outlet obstruction in about 80 % of the patients and fecal incontinence in more than 70 % [29, 30]. This technique also adapts well to the minimally invasive approach. Four ports are placed at the lower abdomen. The left and sigmoid colon are mobilized from the splenic flexure. The peritoneum is incised at the median level, from the inferior mesenteric vessels down to the pelvis. Then the rectum is dissected circumferentially, down to the level of the levator ani muscles. An endoscopic stapler is used to divide the rectum and mesorectum at about 15 cm from the anal verge. Then, the inferior mesenteric vessels are divided between clips. After the site of proximal resection is decided, a 4 cm incision is made at the site of the left port and the redundant sigmoid colon is divided. The anastomosis is performed transanally with a circular stapler. Finally, the rectal stump is fixed to the presacral fascia with non-absorbable sutures at each side [31]. Laubert and colleagues reported the largest experience on 152 patients. Conversion rate was less 1 % mortality rate less 1 % with a major and minor morbidity of 4 % and 19 %, respectively with a mean hospital stay of 11 days. At 4 years constipation was cured in 81 % and incontinence in 67 % with an overall recurrence rate of 11 % [32].

Husa et al. performed this technique on 48 selected patients with complete rectal prolapse. Prolapse recurred in 4 (9 %) of the 45 patients followed up for 1–10 (mean 4.3) years. Bowel habits improved in 23 patients (56 %), especially in those with chronic constipation [33]. However should be considered that resection comes with a risk of anastomotic leakage or stricture [34, 35]. Compared with the Wells' procedure, resection-rectopexy has lower morbidity, but produces similar functional results and has similar relapse rate.

Mesh Rectopexy

Synthetic meshes were introduced into pelvic floor surgery to enhance organ suspension thus reducing the high recurrence rate. There are no doubts that with the use of mesh materials a reduction of recurrence up to 30 % can be observed, but concerns exist about mesh erosion, infection, and dyspareunia. These issues led to the introduction of biological meshes into pelvic floor surgery. A more natural tissue repair was hoped for, thus reducing these risks. The ideal mesh is one that is flexible, shows good tissue integration, has low infection rates, is biocompatible, chemically inert, non-carcinogenic, and non-allergenic [36]. It should also be cost-effective and readily available.

There is currently no consensus on the role of biologics in the surgical management of pelvic organ prolapse and obstructed defecation. Biological meshes appear to be as effective as synthetic meshes in the short-term results. Long-term follow-up is required to ascertain if these findings persist. However, synthetic meshes are associated with the risk of erosion and infection, reasons, why biological meshes were introduced into pelvic floor surgery. Still, there is no convincing evidence proving the superiority of one mesh over the other [37]. Biological meshes consist of a collagen matrix functioning as biological scaffolds for soft tissue remodeling and regeneration, allowing possibly for a "safer" reconstructive procedure regarding their "softer" physical surface qualities, while synthetic foreign materials may support a chronically persistent infection, may it be due to the material itself or its mechanical surface qualities [26]. The abundantly cross-linked dermal porcine collagen (Permacol) is one of the most widely used biological meshes in pelvic floor surgery, as cross-linking delays degradation of the biological material.

Laparoscopic Orr-Loygue Rectopexy

Orr described this elegant technique in 1947 using a strip of fascia lata to anchor the rectum to the sacrum. Loygue et al. as well as Orr et al. subsequently modified the procedure including a full rectal mobilization with a very low prolapse recurrence (3.6 %) despite two deaths [38]. Similarly other authors confirmed low recurrence rates, usually within 10 % [39]. However, despite the initial enthusiasm in terms of
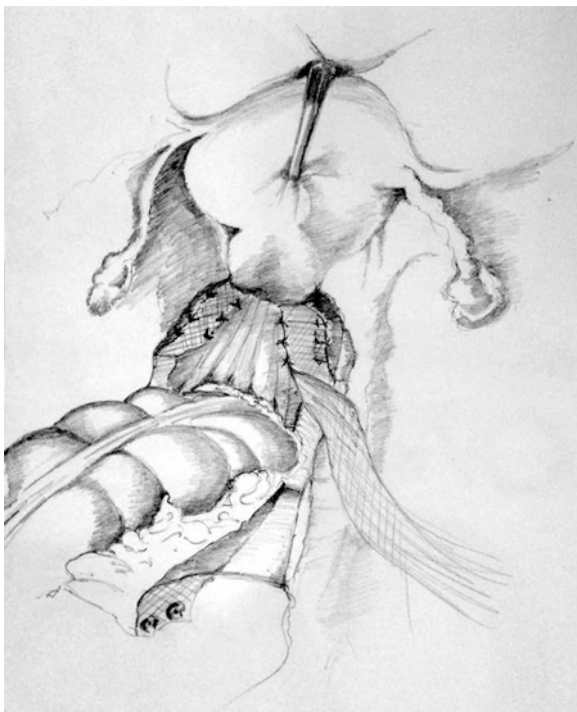
Fig. 12.1 Laparoscopic Orr-Loygue rectopexy: After a limited posterior and lateral rectal dissection, the rectum is fixed to the sacrum using a polypropylene trouser-shaped mesh

low recurrence rates, this approach showed a consistent rate of severe evacuation difficulties over time due to the complete and very low rectal mobilization. Nowadays the Orr-Loygue technique involves a limited posterior and lateral rectal dissection, with no lateral ligament division, and a fixation to the sacrum using a polypropylene trouser-shaped mesh (Fig. 12.1). The mesh is sutured to the antero-lateral rectal walls and its distal ends are sutured to the vaginal fornix or vaginal vault (Fig. 12.2). Despite the reduction of posterior rectal mobilization, however, this altered Orr-Loygue procedure is still associated with new onset constipation [13].

Laparoscopic Ventral Mesh Rectopexy

Firstly described by D'Hoore in 2004, laparoscopic ventral mesh rectopexy (LVR) is effective in treating rectal prolapse associated with obstructed defecation syndrome (ODS) and fecal incontinence (FI) [9, 40], improving respectively in 37–86 % and 4–91 % of the patients [41]. LVR shows good results also on dyspareunia and sexual dysfunction, which improve in 39 % of patients [42].
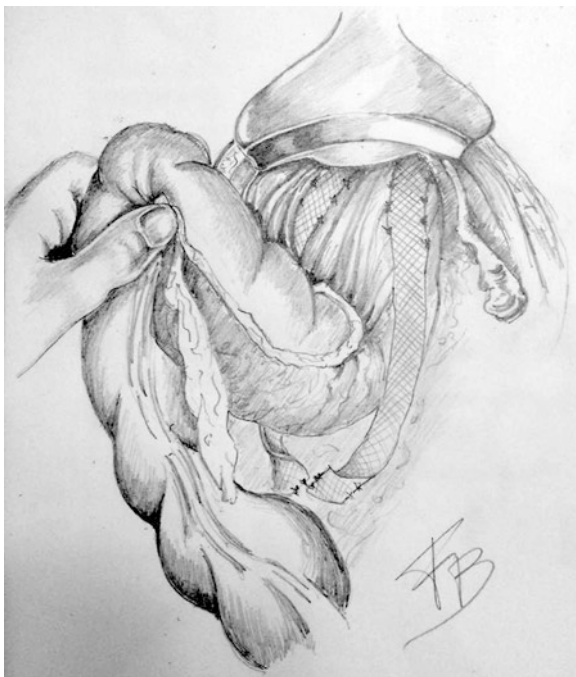
Fig. 12.2 Laparoscopic Orr-Loygue rectopexy: The mesh is sutured to the anterolateral rectal walls and its distal ends are sutured to the vaginal fornix or vaginal vault

Literature data show that LVR can be the treatment of choice for elderly. It also treats the middle as well as posterior pelvic compartment (Colpo-recto sacropexy), rectocele, enterocoele, and sigmoidocoles, if present. Usually it is performed with synthetic meshes which allows stable results but can be associated to a mesh erosion risk close to 3 % during follow-up.

The few reports on LVR using biological mesh show 82–95 % improvement of ODS symptoms and 73–95 % improvement of FI [43] with a significantly reduced risk of erosion. However, new and more data are necessary to establish the superiority of one mesh over the other, in terms of short- and longer-term functional outcomes [44].

Using a four trocar technique and a 30° scope, an anterolateral dissection is carried out between the rectum and the vagina starting from the sacral promontory, down to the levator ani muscle (Fig. 12.3). A 3×18 cm tailored strip of biological mesh is positioned at the level of the levator ani muscle and sutured to the anterior wall of the rectum using two parallel rows of non-absorbable 2-0 sutures (Fig. 12.4).

During this stage, the rectum is retracted cranially in order to visualize the levator ani muscle and the position of the first two distal sutures, which are confirmed to be approximately at 2–3 cm above the dentate line by rectal examination or proctoscopy (Figs. 12.5 and 12.6). The mesh is then sutured to the sacral promontory
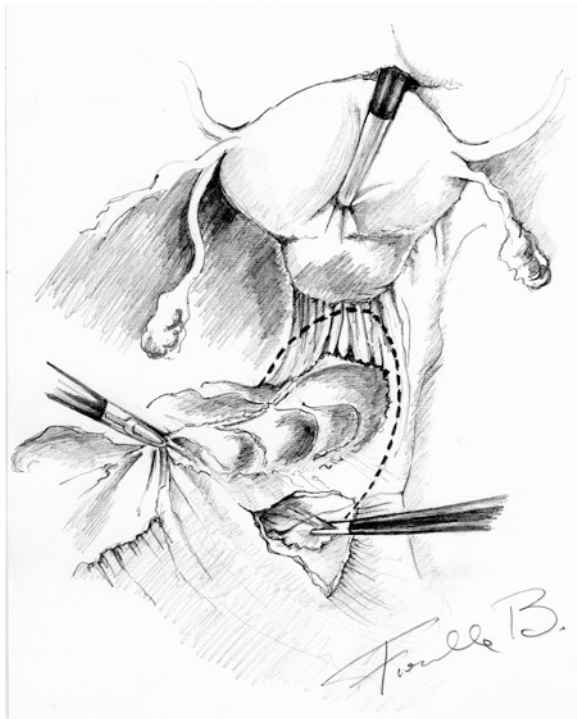
Fig. 12.3 Laparoscopic ventral mesh rectopexy: An anterolateral dissection is carried out between the rectum and the vagina

using non absorbable sutures or the ProTack™ device (Autosuture, Covidien, UK) and the vaginal vault (or cervix) is fixed to the mesh without traction using two additional absorbable sutures (vicryl 2-0), while a retractor is positioned and pulled into the vagina, in order to completely distend the posterior vaginal wall. The surgery is concluded with the closure of the peritoneal incision using a running absorbable 2-0 sutures (Fig. 12.7).

Recently, Formijne Jonkers published a paper about an international survey filled in by the European and American colorectal surgeons regarding evaluation, treatment, and follow-up of patients with internal and external rectal prolapse: LVR is the most popular treatment in Europe, for both external and internal rectal prolapse, while laparoscopic resection-rectopexy (LRR) is the most used technique in North America [45]. The authors concluded that both LVR and LRR are effective for the treatment of rectal prolapse. Although both techniques offer significant improvement in functional symptoms, continence may be better after LRR. However, LRR also has a higher complication rate than LVR.

Fig. 12.4 Laparoscopic ventral mesh rectopexy: A biological mesh is positioned at the level of the *levator ani* muscle and sutured to the anterior wall of the rectum. The mesh is then sutured to the sacral promontory using the ProTack™ device

Laparoscopic Ripstein Technique

The Ripstein technique, initially described by Ripstein in 1965, was the most diffuse approach to treat rectal prolapse in USA before the introduction of sutured posterior rectopexy. It involves a complete mobilization of the rectum and its fixation at the hollow of the sacrum using a sling of Teflon, Marlex, or Gore-Tex to place around the anterior surface of it and bilaterally anchored on the sacrum. The mesh is trimmed before positioning and sutured on the seromuscular of the rectum with the rectum under cranial retraction. The suturing is started usually in the right aspect of the sacrum and ended on the left side leaving a centimeter behind the mesh to avoid tension and stricture at this level. Three to five non-absorbable sutures are used (Fig. 12.8). The laparoscopic approach is carried on similarly to the open. However, the results in terms of constipation are disappointing with a persistence

Fig. 12.5 Laparoscopic ventral mesh rectopexy: The rectum is retracted cranially in order to visualize the *levator ani* muscle and the position of the first two distal sutures, which are at 2–3 cm above the dentate line

rate of preoperative constipation as high as 57 % (compared to 17 % after resection-rectopexy, $p=0.03$). Moreover, in 12 % of patients a new onset of constipation was described, reason why this procedure should be avoided in case of rectal prolapse with constipation [46].

Wells' Technique

The Wells technique consists of the opening of the pararectal peritoneum on both sides to the holy plane, with a dissection of the mesorectum down to the level of the levator ani plane, avoiding any injuries of the presacral nerve plexi. The peritoneum is entered at the ombelicus with three additional trocars placed in the right lower
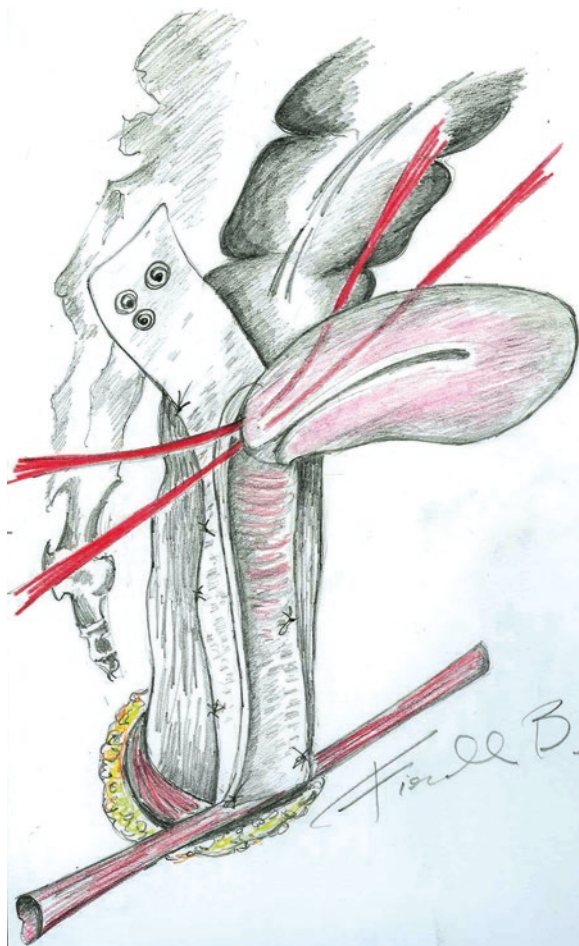
Fig. 12.6 Laparoscopic ventral mesh rectopexy: The rectum is retracted cranially in order to visualize the *levator ani* muscle and the position of the first two distal sutures, which are at 2–3 cm above the dentate line

quadrant on the anterior axillary line, at the level of the iliac crest, and the last in the lower left quadrant. If necessary, an additional trocar is placed suprapubically. Dissection is initiated opening the right-sided parietal peritoneum lateral to the rectum. A retro-rectal window is created anteriorly to the sympathetic plexus. The dissection is conducted down to the levator ani muscle. Then the sacral promontory is completely exposed reaching the iliac common vessels on the right side. A nonabsorbable mesh is tailored in a T shape and oriented with the long limb of the 'T' along the hollow of the sacrum and the short arm behind and perpendicular to the rectum at the level of the sacral promontory. The mesh is then fixed to the sacrum and its lateral wings are fixed laterally to both sides of the rectum [47]. Using this
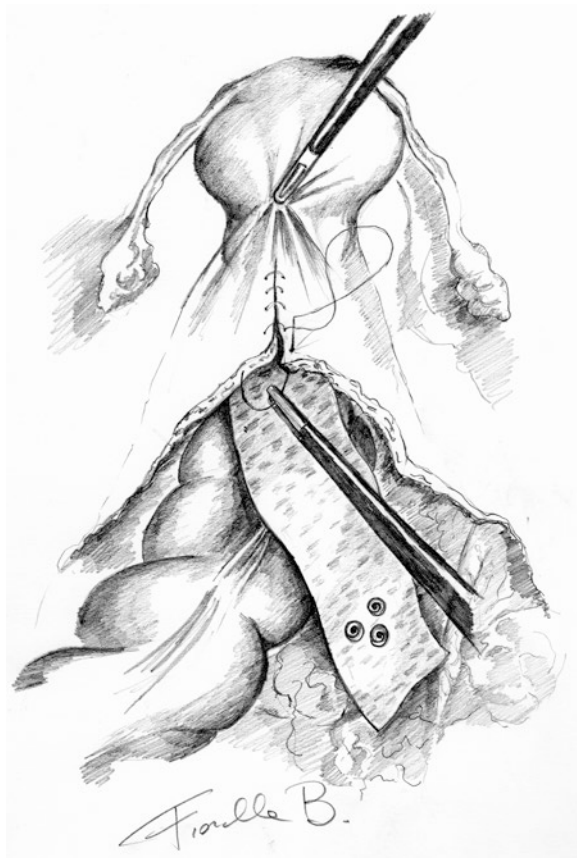
Fig. 12.7 Laparoscopic ventral mesh rectopexy: Closure of the peritoneal incision using a running absorbable 2-0 sutures

technique, constipation improvement is achieved in 36 % of cases, while there is an 18 % new onset constipation [48]. Laparoscopy has also been successfully applied to this technique, with no major intraoperative or postoperative complications. In a series of 37 patients who had undergone laparoscopic Wells technique, incontinence was cured in 92 % of patients, while a not acceptable 38 % rate of postoperative constipation was described [49].

Pelvic Organs Prolapse Suspension

This is a new technique developed by Longo which aims to address not only the posterior but also the middle and anterior pelvic compartments prolapse. Using a three-trocars technique the operation starts with an exploration of the
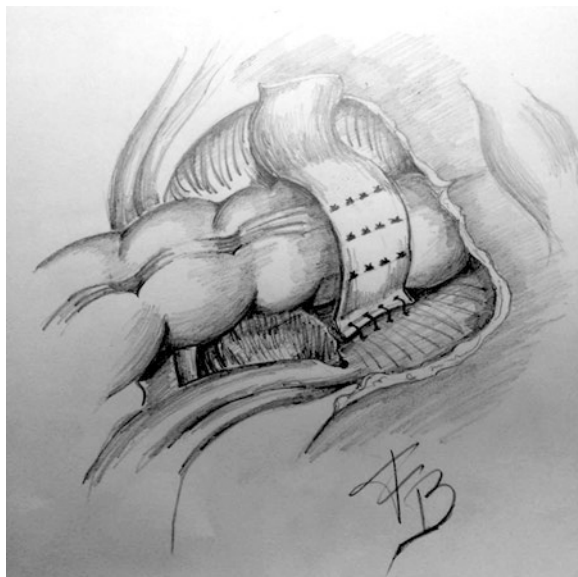
Fig. 12.8 Laparoscopic Ripstein technique: After complete mobilization of the rectum, it is fixed at the hollow of the sacrum using a sling of Teflon, Marlex, or Gore-Tex, placed around the anterior surface of it and bilaterally anchored on the sacrum

peritoneal cavity. The patient is then positioned in Trendelenburg. A vaginal flat retractor is positioned into the anterior fornix. A 30×30 cm prolene mesh is tailored in a V-shaped 25-cm length strips and 2 cm wide and introduced into the abdominal cavity through the 10-mm trocar. A 2-cm incision of the peritoneum is performed at the level of the apex of the anterior vaginal fornix, where the mesh is fixed using a 0 prolene stitch. Then, 2-cm bilateral cutaneous incisions are performed 2 cm above and 2 cm posteriorly to the anterior superior iliac spine and a subperitoneal plane is reached. Through this incision, a forceps is introduced and, under laparoscopic vision, a subperitoneal tunnel is created until reaching the anterior fornix of the vagina. At this point, the tip of the clamp is forced out of the peritoneal incision previously performed and one end of the V-mesh is pulled out through the subperitoneal tunnel, bilaterally. Pelvic organ suspension is achieved by making symmetrical tractions on both mesh strips. Finally, 5 cm of excess mesh strip is fixed to the muscles' fascia using vicryl 2/0 stitches. At the end of the procedure, a circular anal dilator (CAD) is positioned and an evaluation of the rectal prolapse is performed. If a residual recto-anal prolapse and/or an anterior rectocele is still evident, a STARR (Stapled TransAnal Rectal Resection) procedure is performed.

The overall rate of surgical complications was 14.3 %. The Longo's ODS score fell from an average of 14.55 to an average of 3.03 [50]. F. Ceci et al. evaluated the preliminary results of laparoscopic POPs + STARR in 54 women with a mean age

of 55.2 and a BMI of 28.3. The authors had no relapses and the preliminary results were excellent (rectocele treated in 83 %, rectal prolapse treated in 76 %, enterocele-treated in 57 %); there were no cases of de novo dyspareunia, and all patients with this preoperative affliction reported cure or significant improvement at 1 year of follow-up [51]. However larger series with data and longer-term follow-up are needed.

Robotic Rectopexy

Robotic assistance in laparoscopic surgery may help in shortening operating times and the surgeon's learning curve in some laparoscopic tasks. Several studies demonstrated that robotic rectopexy is safe and feasible, leading to high-definition stereoscopic vision and intuitive tremor-free movements of instruments, excellent ergonomics, and motion scaling. However, significantly longer operating times compared to the laparoscopic technique have been described, probably due to the limited experience in robotic surgery at this moment and to the laborious difficulty in changing robotic instruments [52]. In a series of 44 patients who had undergone robotic-assisted ventral mesh rectopexy compared to 74 patients who had undergone laparoscopic ventral mesh rectopexy, early complications were significantly lower following the robotic approach. Also, ODS scores demonstrated a significantly better effect on constipation with the robotic-assisted approach, probably due to several technical advantages of robotic-assisted surgery, such as improved autonomic nerve-sparing, deeper mesh placement, and major reduction of rectocoeles. There were no differences in recurrence rates and postoperative sexual function between the two groups [53].

The procedure is the same as in the laparoscopic procedures previously described, and performed with the aid of the four-armed Da Vinci-S surgical system (Intuitive Surgical Inc., Sunnyvale, California, USA). Deep access and dissection in the pelvis is easier with the robotic arms, with the possibility of suturing the mesh to the lateral stalks of the rectum [51].

Robotic-assisted rectopexy may be performed also in elderly patients, with no differences in terms of recurrence, short- and long-term function for both young and old patients [54].

Robotic surgery has higher costs than the laparoscopic approach, but it is likely that in the future newer, portable, and cheaper robotic systems will be developed. In combination with the clinical advantage of improved function the somewhat higher costs may be outweighed [55].

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