Robotic Surgical Management of Combined Vaginal and Rectal Prolapse

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Introduction

Rectal prolapse is a dynamic disorder caused by damage to the pelvic support structures, which has been attributed to the shearing forces of vaginal childbirth, connective tissue disorders, neuropathy, congenital defects, chronic constipation, or pelvic surgery [1]. This pelvic floor weakness often affects the entire pelvic floor muscular diaphragm resulting in the descent of one or more of the pelvic organs (i.e., uterus, vagina, bladder, rectum). It is estimated that up to 50% of parous females will experience partial or complete prolapse of one or more organs in their lifetime

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[2, 3]. Pelvic organ prolapse is becoming a significant concern in the aging population, and the prevalence in the United States is expected to increase by 46% to 4.9 million cases by the year 2050 [4].

Traditionally, the medical and surgical management of pelvic organ dysfunction was confined to each specialty. Urologists and gynecologists would repair pelvic organ prolapse of the anterior and middle (apical) compartments, while separate treatment would be performed by a colorectal surgeon for posterior compartment (rectal) prolapse. Addressing the combined pathology in a piecemeal approach likely alters the physical stressors of the non-treated compartments. This compartmentalized approach resulted in higher prolapse recurrence, worsening prolapse of a different compartment, and worsening bowel symptoms. In addition, it results in additional surgeries for the patient. Virtanen and colleagues found that isolated treatment of middle compartment prolapse by sacrocolpopexy resulted in 26% of patients developing constipation, 22% developing difficulty with evacuation, and 26% developing pain and pressure during defecation (this can be from the prolapse and possibly enterocele) [5]. In fact, concomitant pelvic floor disorders such as cystocele, enterocele, and rectocele are present in 15–30% of patients with rectal prolapse [6, 7]. A multidisciplinary approach combining the expertise of colorectal surgeons, gynecologists, and urologists is

essential for the treatment of women suffering from multi-compartment prolapse in order to optimize surgical outcomes aiming for the lowest recurrence, improved bowel function, and better quality of life.

Patient Evaluation

Every woman being evaluated for pelvic floor dysfunction should be routinely questioned regarding the presence or absence of symptoms within all three pelvic compartments: anterior (bladder), apical (vault/uterus), and posterior (rectum). Specific questioning for symptoms associated with pelvic floor disorders such as urinary incontinence, fecal incontinence, or organ prolapse needs to be performed. Many women suffering from these disorders are too embarrassed to inform their doctor or have the perception that these symptoms are a normal part of aging and, therefore, untreatable. Patients with pelvic organ prolapse can present with a myriad of symptoms (Table 11.1). Important questions to ask patients regarding rectal prolapse include:

1. Do you have a protrusion from the rectum?
2. How often does the protrusion occur? With each bowel movement? Does it occur with standing or coughing?
3. Do you need to push the prolapse in or does it spontaneously reduce?
4. How long have you had the prolapse?
5. Do you have a history of constipation and straining?
6. Do you suffer from fecal incontinence? If so, to what extent?

Table 11.1 Symptoms of pelvic organ dysfunction

Pelvic pressure or heaviness
Urinary incontinence or retention
Fecal incontinence
Constipation
Protrusion or bulge from vagina and/or rectum
Pain
Rectal bleeding or mucous discharge

A thorough physical examination evaluating all the pelvic floor compartments is essential for determining what surgical treatment to recommend. It is important to note that complete rectal prolapse (rectal procidentia) is a full-thickness protrusion of the rectum through the anus (Fig. 11.1), while incomplete rectal prolapse (partial rectal procidentia) consists of internal rectal prolapse to, but not through, the anal canal. Both represent degrees of severity along the continuum of pelvic floor prolapse and should be appropriately diagnosed and treated.

The simplest method of diagnosing complete rectal prolapse is to visualize this in the office by having the patient reproduce the prolapse while straining in the left lateral position or while sitting on a commode. Sometimes it can be difficult to reproduce, and we have found it helpful for patients to take a photograph at home. In addition, rectal examination should focus on evaluation of sphincter tone and function, as well as the presence of a patulous anus, rectocele, solitary rectal ulcer, and/or rectal mass. How do we know who should be referred for more than a

Fig. 11.1 Complete rectal prolapse (rectal procidentia)

sacrocolpopexy? If patients deny having a protrusion or defecation problems, we do not think any further work up is necessary. But, the right questions need to be asked. Many patients will not openly tell you unless you ask. In addition, many patients either think it is their hemorrhoids or are afraid it may be something worse such as cancer and so they don't inform anyone.

While vaginal and rectal prolapse are diagnosed by physical examination, the presence and extent of associated pelvic floor dysfunction requires dedicated imaging studies. Fluoroscopic defecography (Fig. 11.2) or dynamic magnetic resonance imaging (MRI) (Fig. 11.3) prove

Fig. 11.2 Example of flouroscopic defecography

critical in identifying the various anatomic defects present and ensuring the involvement of appropriate specialties in an attempt to improve surgical outcomes and decrease recurrence. There is consensus that most types of vaginal prolapse can be staged and surgery planned without imaging. In fact, most "enteroceles" that occur in the setting of high stage vaginal vault prolapse are without symptoms and are addressed by a sacrocolpopexy without formal enterocele repair. However, rectal prolapse is often caused by severe straining caused by an enterocele that protrudes between the posterior vaginal wall and the anterior rectum (usually in the setting of good apical vaginal support). In the setting of rectal prolapse, it is very important to obtain if the patient has an enterocele. A common mistake is to correct the prolapse without repairing the enterocele. This results in a very high recurrence rate. Additional preoperative studies may be warranted based on the patient's clinical evaluation which are beyond the scope of this chapter (Table 11.2).
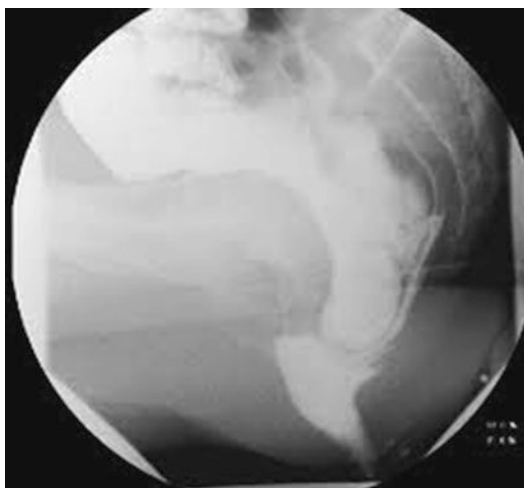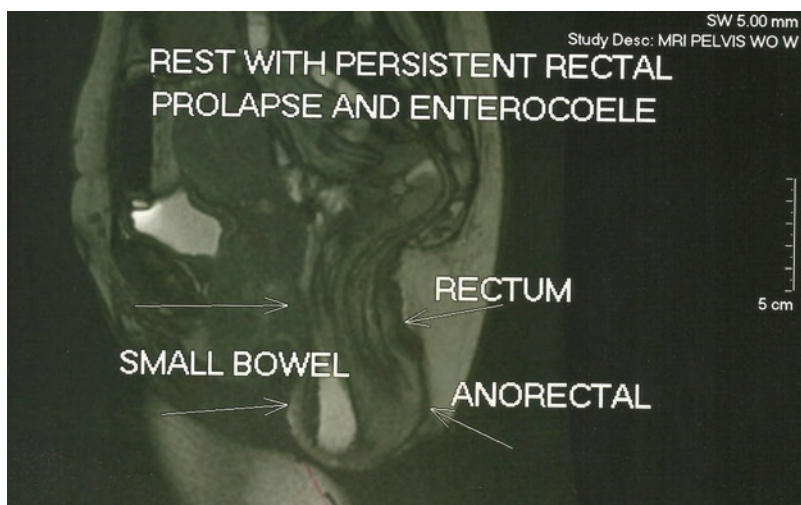
Surgical Treatment of Multi-visceral Organ Prolapse

Although much progress has been made regarding the preoperative assessment and necessity for a combined surgical repair when addressing multi-visceral organ prolapse, the optimal

Fig. 11.3 Dynamic magnetic resonance imaging of rectal prolapse. Note the enterocele, which results in severe straining and likely exacerbated her rectal prolapse symptoms

Table 11.2 Ancillary preoperative studies and imaging

Colonoscopy
Anal manometry
Urodynamics
Cystoscopy
Colonic Transit Marker Study

procedure for treatment of this disorder is still not defined. In our practice, we approach all pelvic reconstruction surgery through a multidisciplinary approach with colorectal surgeons, urologists, and gynecologists discussing the pathology, patient selection, and approach. In our opinion, this offers the best chance for curative intervention with the aim of improving symptoms and quality of life.

Abdominal sacrocolpopexy is considered the gold standard procedure for the surgical correction of vaginal vault prolapse. Sacrohysteropexy is an option for women who wish to preserve their uterus (*see* Chap. 9). Simultaneous repair of rectal prolapse includes anterior or posterior rectopexy, with or without placement of mesh, and with or without sigmoid resection. Watadani and colleagues studied open sacrocolpopexy and rectopexy for combined middle and posterior compartment prolapse, demonstrating that it is a safe procedure with low risk of recurrence, improved bowel function, and improved quality of life scores [8]. Many surgeons have transitioned to performing this procedure through a minimally invasive approach, initially with laparoscopic instrumentation and, more recently, with robotic technology. This evolution of approach is born from the enhanced capabilities of robotic instrumentation for operating in the deep pelvis as compared to rigid laparoscopic instruments. For years, surgeons operating in the pelvis have had to adapt to the limitations of laparoscopic instrumentation, which include operating at an oblique angle in the cone-shaped pelvis utilizing static instrumentation. However, robotic surgery mimics the surgeon's maneuvers and is more consistent with open surgical techniques. The da Vinci surgical system has several advantages including three-dimensional visualization, wristed instrumentation that restores seven degrees of freedom, zoom magnification,

and a third working arm. The end result is finer dissection with improved exposure, visualization, and suturing (particularly anteriorly and deep to the sacral promontory). Previously, deep pelvic dissection and the required pelvic suturing proved challenging and was limited to expert laparoscopic surgeons. The learning curve for robotic surgery, especially in the pelvis, does not appear as steep as for traditional laparoscopic surgery [9].

Combined Robotic Sacrocolpopexy and Posterior Rectopexy: Techniques and Surgical Options

Rectopexy vs. sigmoid resection. There is no consensus among colorectal surgeons about the best approach for repair of rectal prolapse. Traditionally, if a patient has severe constipation associated with a redundant sigmoid colon and rectal prolapse, she is recommended to have sigmoid resection and rectopexy. If there is no evidence of a redundant sigmoid colon, then a rectopexy alone is advised. This continues to evolve as new techniques emerge such as the ventral mesh rectopexy that will be discussed later in this chapter.

Step 1. Intubation

The patient is placed directly on a thick foam pad on the operating table in order to prevent sliding with Trendelenberg position during the operation. After general endotracheal anesthesia is administered, the patient is placed in low lithotomy position in Allen stirrups. The patient's arms are padded with foam and tucked at the sides. A urinary catheter is then placed in a sterile field.

Step 2. Port Placement

Once the abdomen and perineum are prepped and draped, a 12 mm curvilinear incision is made in the periumbilical position. A Veress needle or a Hassan technique is used to achieve trocar placement, followed by insufflation to 12–15 mmHg

Fig. 11.4 Port placement
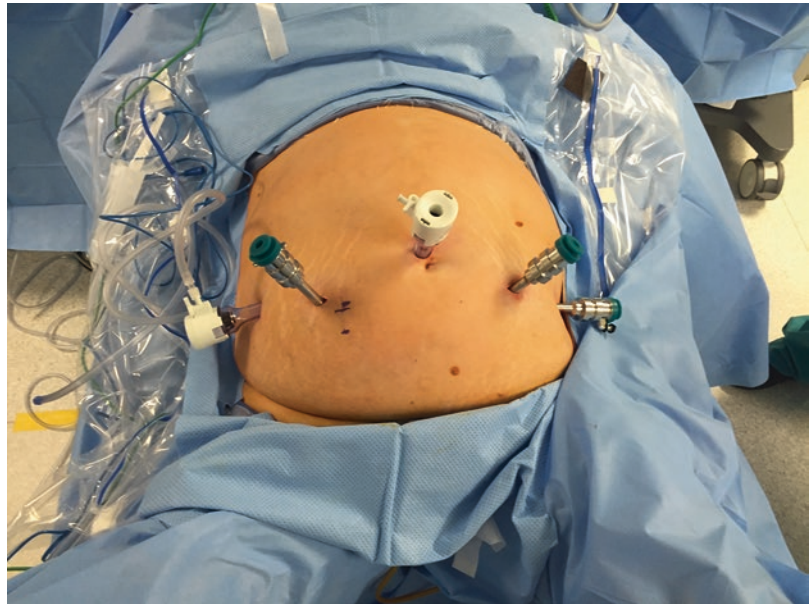
CO_2 pneumoperitoneum. The da Vinci camera (Intuitive Surgical, Sunnyvale, CA) is introduced and a general inspection is performed. A 0° or 30° down camera can be used, based on surgeon preference. We prefer the 30° down scope because we can visualize over the sacral promontory better in the presacral space.

Under direct visualization, two 8-mm trocars are placed on each side along the mid-clavicular line just below the umbilicus. A third 8-mm trocar is placed in the left lower abdomen along the mid-axillary line. Finally, a 1-mm trocar is placed at the right lower abdomen along the mid-axillary line as an assistant port approximately 4 cm above the anterior superior iliac spine. The Si robot arms should be placed a minimum of 10 cm apart in order to avoid arm collisions; however, the robotic arms can be placed closer with the Xi robot (Fig. 11.4).

Step 3. Docking

The patient is placed in steep Trendelenberg position with slight left side up. The da Vinci bedside cart is side-docked in order to maintain access to the vagina and rectum during the course of the procedure (Fig. 11.5). The small bowel is retracted out of the pelvis and the relevant pelvic landmarks are identified.

Step 4. Instrumentation

Once the robot is docked, monopolar shears are placed in the number 4 (right lower quadrant) port. A bipolar grasper is placed in the number 3 (left mid-clavicular) port, and either a Prograsp forceps or Cadiere forceps is placed in the number 1 (left mid-clavicular) port with the camera at the supraumbilical port. For the left-handed surgeon, the instruments in ports 1 and 3 are reversed. The Cadiere forceps is less traumatic for retracting the sigmoid mesentery, while the Prograsp forceps improves traction for manipulation of the more sturdy pelvic structures. We would recommend starting with the Cadiere forceps and only switch to the Prograsp forceps if the Cadiere is unable to properly retract the tissues such as the mesentery.

Step 5. Mobilization of the Sigmoid Colon and Rectum

The sigmoid colon is mobilized out of the pelvis. The sigmoid mesentery is retracted up and towards the left to identify the superior hemorrhoidal vessels and sacral promontory. Using the monopolar shears, the peritoneal reflection is opened starting approximately 2 cm above and just to the right of the sacral promontory and
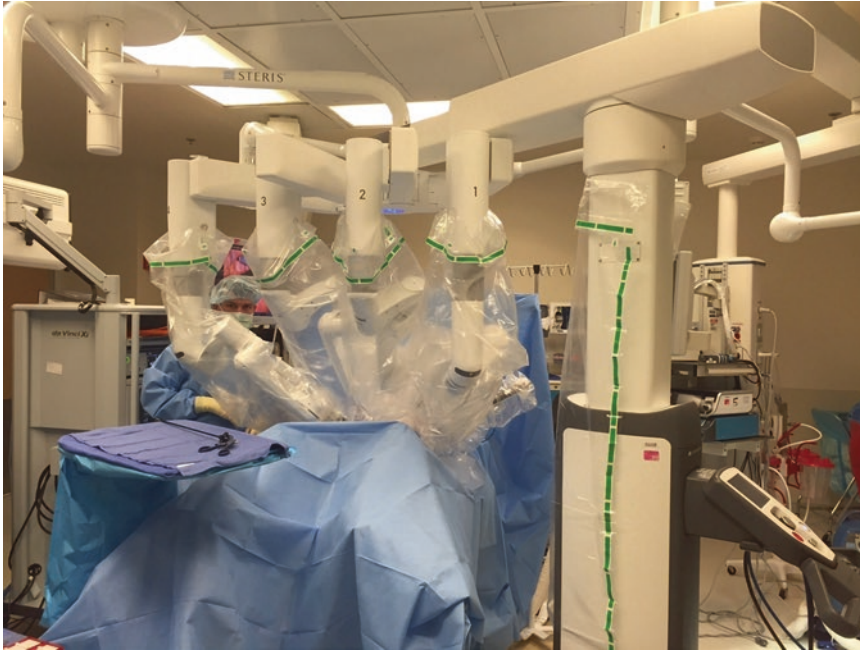
Fig. 11.5 DaVinci Xi Robot system docked in place using a side-docking technique

extending down to the rectovaginal septum. Care is taken to identify and preserve the right ureter. Using careful dissection, the superior hemorrhoidal vessels are elevated off the retroperitoneum and the left ureter is identified through the length of the dissection. Once all anatomic structures are properly identified, the rectum and mesorectum are mobilized using monopolar shears to complete the dissection as far inferiorly as the pelvic floor musculature. The hypogastric nerves are identified posteriorly and carefully preserved during this dissection. This portion of the dissection is usually performed by the colorectal surgeon.

Step 6. Sacrocolpopexy

Once the rectum is mobilized, the sacrocolpopexy is performed by the urologist, urogynecologist, or gynecologist as described by several authors [10, 11]. The presacral dissection is facilitated by the sigmoid mobilization already performed, though often Female Pelvic Medicine and Reconstructive Surgery (FMPRS) surgeons perform additional dissection until the anterior longitudinal ligament is fully exposed. The vaginal peritoneum is incised and the vagina is dissected free from the bladder and prerectal fat. A Y-shaped piece of mesh or graft (or two separate pieces, based on surgeon preference) is sutured to the vaginal apex and anterior and posterior vaginal walls with permanent suture. The tail end of the mesh is attached to the anterior longitudinal ligament at the sacral promontory as described elsewhere in this book.

Step 7. Posterior Rectopexy

The colorectal surgeon returns to the console to perform the rectopexy. The rectum is elevated cephalad and the cuff of the mesorectum is sutured to the sacrocolpopexy mesh or just above it with permanent suture. We prefer to use 2-0 Gortex or 2-0 Ethibond suture. We place two to three figure-of-eight sutures on the right side of the mesorectum. The peritoneum is closed over the mesh with absorbable sutures of 2-0 Vicryl.

Surgical Options

Redundant Sigmoid Colon

In patients with a redundant sigmoid colon diagnosed by either colonoscopy, barium enema or dynamic MRI, and constipation symptoms, a concomitant sigmoid colon resection may be warranted. In this situation, the sigmoid colon and rectum are mobilized as previously described. The distal transection is performed at the top of the rectum, identified as the individual taenia coli splay out to cover the rectum circumferentially. The mesentery is ligated with either with a vessel sealer or a vascular-loaded stapler. The rectum is transected with the robotic stapler (usually with a green load stapler that have larger size staples). The proximal resection point is selected by identifying an area of healthy colon that will allow for a tension-free anastomosis with removal of the redundant portion of colon and also allow for the remaining colon to cradle without tension along the left lateral side wall. Once this is completed, the robot is temporarily undocked and a small Pfannenstiel incision is made. The redundant colon is removed and the proximal bowel is transected. A circular anvil is placed in the colotomy. A purse-string suture is created using 2-0 Prolene at the end colotomy. A circular anvil is placed through the colotomy and secured in place with the purse-string suture. The colon is then returned to the abdomen and the fascia is closed. The abdomen is re-insufflated, an endoanal circular stapler is introduced transanally, and the anastomosis is performed in the traditional manner with straight laparoscopic instruments. Once insufflation is re-established, the proximal colon is aligned properly along the left lateral side wall. The mesentery should be facing medially to avoid a rotation of the colon. Following a rectal examination, the endoanal circular stapler is introduced in the rectum and carefully advanced to the staple line. Under direct visualization, the spike is brought out adjacent to the staple line in the middle of the end rectum. The anvil on the proximal bowel is grasped and secured to the spike. Prior to closing the instrument, all areas are carefully inspected to make sure the bowel is

aligned properly again as well as to assure there is no incorporation of any surrounding tissues. The circular stapler is closed, fired, and removed. The anastomosis is evaluated both with an air leak test and flexible sigmoidoscopy. After normal saline is placed in the pelvis, the proximal bowel is gently occluded with a grasper. A sigmoidoscopy is performed to check for any evidence of an air leak at the anastomosis and to visually inspect the anastomosis. Upon completion of the anastomosis, the robot is returned to the field and the remaining portion of the surgery is continued.

When the sigmoid resection and sacrocolpexy are combined, there are unique considerations to consider surgically. First, based on surgeon preference, we often use acellular human dermis allograft instead of mesh (Flex HD® allograft, extra thick) in the event of a colon leak. Second, we take a "tag team" approach. After the sigmoid resection, the presacral and vaginal dissections are performed (± hysterectomy). Based on surgeon preference, the vaginal mesh/graft attachments can be performed prior to the sigmoid resection, so that as much surgery is completed before the bowel anastomosis is done. Then, the vaginal mesh/graft is attached to the sacral promontory with two, 2-0 Gore-Tex sutures. At this time, the rectopexy is performed by tacking the sigmoid directly to the sacrocolpopexy graft/mesh (our preferred approach), or by tacking it to the promontory directly. Any concomitant vaginal procedures are performed at the end of the case, often at the time of port closure.

Ventral Mesh Rectopexy

Anterior placement of mesh to the rectum and a ventral rectopexy has gained popularity. This technique allows for anterior mobilization of the rectum with the mesh secured between the ventral aspect of the rectum and posterior aspect of the vagina and then attached at the sacral promontory [12]. This avoids dissecting in proximity to the pelvic nerves and sacral venous plexus as required with the posterior approach. Ventral mesh rectopexy has become an established procedure for the treatment of

both internal and external rectal prolapse [13]. This technique has been performed in Europe for a number of years and is currently establishing footsteps in the United States. A combined sacrocolpopexy can readily be performed with this technique. The general consensus in the United States is to use biologic mesh for the ventral rectopexy. Biologic or synthetic mesh can be used for the sacrocolpopexy.

Robotic Sacrohysteropexy

In women who desire a uterine-sparing procedure, robotic sacrohysteropexy is an option, as described by Rosenblum [9]. Laparoscopic or robotic approaches have been shown to have less operative bleeding, shorter operative times, and fewer post-operative symptoms as compared to an open approach for sacrohysteropexy [14].

In a study reviewing their experience with laparoscopic sacrohysteropexy, Rosenblum et al. documented zero intraoperative complications (0/15) and that uterine prolapse improved in all patients undergoing this procedure. However, the same study noted that only 12 (80%) women appreciated symptomatic improvement [15]. On the contrary, a larger European trial reported overall patient satisfaction to be above 95% after undergoing this procedure [16]. Robotic sacrohysteropexy is described in more detail in Chapter 9, but deserves mention here since we see young women with symptomatic rectal prolapse who are found to have significant uterine prolapse by exam or by history. Many of these women are of childbearing age and wish to preserve fertility. In these cases, we have had success with a posterior strip sacrocolpopexy with acellular human dermis (Flex HD® allograft, extra thick), often in combination with an anterior repair performed vaginally at the end of the case. It should be mentioned that numbers are small, follow-up is short, and data is lacking on outcomes of delivery after sacrohysteropexy. Nonetheless, with proper patient counseling, this is a safe option for women at a uniquely high risk of vaginal and rectal prolapse recurrence.

Mesh: Biologic Versus Synthetic

With the increased public awareness of the FDA safety communications regarding synthetic mesh and vaginal prolapse repair, the use of mesh versus biologic graft, especially in the setting of concomitant sigmoid resection, remains a very highly debated issue. Some studies have compared native tissues (cadaveric fasica lata) to mesh-based sacrocolpopexy and have showed poor long-term results with fascia lata (93% success at 1 year in mesh group vs. 62% in fascia lata group [17]). This increase in anatomic success comes with the cost of significant mesh extrusion rates (up to 19%). In our hospital's experience of 78 women randomized to robotic versus laparoscopic ASC, however, mesh-related complications were acceptably low. Covering the mesh with peritoneum and performing supracervical (vs. total) hysterectomy for uterine prolapse are important steps in reducing mesh-related complications. When biologic graft is preferred, it is likely that newer biologic materials, specifically acellular cadaveric dermis, hold more promise than cadaveric fascia lata. No difference has been uncovered in terms of dyspareunia or sexual function between mesh and non-mesh repairs [18].

Given the concern for erosion and other post-operative complications with the use of synthetic mesh (most commonly polypropylene), many have investigated the use of biologic mesh as a substitute. This material is much more costly, but comes with easier handling properties and is less prone to infection. Thus, when performing sigmoid colectomy in addition to vaginal floor repair as described above, biologic mesh may be considered. In addition, the biologic meshes confer a lesser degree of adhesiogenesis and may decrease the rate of post-operative bowel obstructions. They also allow us to forego the step of covering the mesh with peritoneum, which saves time. While the final outcome on the biologic versus synthetic mesh debate remains unknown, a small study has compared synthetic and biologic mesh in ventral mesh rectopexy. In this study, there was no difference in recurrence or mesh complications (3.7 vs. 4.0% and 0.7 vs. 0.0%) [12].

Outcomes

As discussed previously, a combined multidisciplinary approach is essential for the best possible surgical outcomes. When looking at combined sacrocolpopexy and rectopexy, there are significant improvements in the pelvic floor distress inventory (PFDI) and patients with mixed symptoms significantly improved in terms of their colorectal distress [8, 19].

Mesh can be safely inserted, but further data is needed to clarify the biologic versus synthetic debate. In addition, sacrocolpopexy can be performed in an open manner, but can also be done with a minimally invasive technique. While there is a paucity of data comparing the efficacy of a laparoscopic versus robotic technique [20], some small studies have shown that urinary and gastrointestinal symptom improvement is better with robotic procedures [21].

Conclusions

Pelvic organ prolapse remains an important clinical problem for many women with the expectation of an increased incidence in the future. Surgical management with a multidisciplinary approach remains the procedure of choice for cure. Both laparoscopic and robotic approaches are viable and likely represent an improvement over open techniques.

The use of mesh has been shown to decrease recurrence, although this comes with the addition of the risk for mesh extrusion and mesh infection (in the setting of bowel injury or an anastomotic leak). Both synthetic and biologic grafts have been used safely, and the choice should be determined by the concomitant procedures (i.e., bowel resection), graft availability, and the results of future, well-designed studies.

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