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Current Status and Surgical Technique for Restorative Proctocolectomy with Ileal Pouch Anal Anastomosis

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Restorative proctocolectomy with ileal pouch-anal anastomosis (RP/IPAA) is the procedure of choice for patients with ulcerative colitis (UC), some patients with colonic Crohn's disease (CD), and those with familial adenomatous polyposis (FAP); albeit, owing to its complexity, it should be performed by experienced professionals. RP/IPAA is the recommended surgical treatment for UC when the standard medical therapy is ineffective. This procedure has been demonstrated to provide patients with a good quality of life, such as in FAP patients with extensive disease in the rectum. The CD has been associated with higher rates of perianal involvement and disease recurrence, but some patients with CD limited to the large intestine and minimal perianal or ileal disease may also be considered for this operation. First, all patients undergo a detailed preoperative evaluation that includes a review of previous imaging, pathology, and colonoscopy findings, a perianal examination, an evaluation of the anorectal functions, mechanical bowel preparation, and prophylaxis against deep venous thrombosis and infectious complications. A staged approach is the most commonly preferred technique for RP/IPAA, which can be performed in 2 or 3 stages. The IPAA can be performed by laparoscopic, robotic, or open approach. The type of approach is determined based on the patient's condition, medication used, elective or emergency setting, and the surgeon's expertise level. A successful IPAA requires tension-free pouch anastomosis. The most common IPAA pouch types are the J or S pouches; alternatively, an H pouch may be created, which is mainly used in redo pouches. In experienced centers, > 95% of the patients become stoma-free in 10 years. IPAA is a complex procedure, and the complications after pouch surgery are pouchitis, pelvic sepsis, pouch failure, or anastomotic stricture. The majority of long-term complications can be prevented in such cases with a comprehensive preoperative evaluation and through the use of appropriate surgical techniques and postoperative care conducted at experienced centers. The techniques for performing RP/IPAA with their long-term outcomes have been reviewed in this article.

Restorative proctocolectomy with ileal pouch-anal anastomosis (RP/IPAA) is the procedure of choice in patients with ulcerative colitis (UC), some patients with colonic Crohn's disease (CD), and those with familial adenomatous polyposis (FAP). RP/IPAA is a complex procedure that requires significant experience in terms of the operative technique and postoperative management; therefore, it is recommended to be performed by centers experienced in the medical and surgical management of inflammatory bowel diseases.

UC is characterized by inflammation of colonic mucosa from the distal rectum to the proximal colon in a continuous extension pattern.[1] The majority of the patients get treated effectively through medical management; however, 15-30% of the patients eventually require colectomy.[2,3] The indications for colectomy in UC include poor response to medical therapy, steroid dependency, dysplasia/neoplasia, and the failure to thrive.[4] RP/IPAA is the surgical gold standard treatment for UC to maintain intestinal continuity and achieve a good quality of life.[5-8]

CD is a condition characterized by chronic, granulomatous, and inflammatory patterns that can affect the entire gastrointestinal tract, but typically involves the ileocolic region. In around 60% of the cases, both the small, and large intestines are affected, but approximately one-third of all CD patients show only colonic involvement.[9] Patients with colonic CD often experience extra-intestinal manifestations, such as arthritis, cutaneous and ocular

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manifestations, and primary sclerosing cholangitis. The colonic CD has also been associated with a higher possibility of perianal involvement (77% versus 23% in small bowel CD).[10] It is therefore important to consider the presence of rectal or perianal CD when deciding on the type of surgery as it increases the risk of disease recurrence and the chances of pouch loss after an IPAA when compared to their counterparts with UC or intermediate colitis.[11] RP/IPAA can be performed in selected patients with CD that is limited to the large intestine with no or minimal perianal disease or ileal disease.

FAP is characterized by numerous adenomatous polyps by APC mutation in the colon and rectum and is usually diagnosed in the third decade of life.[12] FAP is characterized by the development of > 100 colorectal adenomas, resulting in an early onset colorectal cancer that necessitates surgical intervention for the prevention of cancer.[13] Total colectomy with ileorectal anastomosis can be performed if the rectum is spared, and it is associated with better functional outcomes when compared to RP/IPAA. However, RP/IPAA is indicated in patients with extensive disease in the rectum as it provides a good quality of life.

In this article, we have reviewed the techniques to perform RP/IPAA as well as the long-term outcomes associated with it.

Preoperative evaluation

All patients undergoing RP undergo a detailed preoperative evaluation. Previous imaging, pathology, and colonoscopy findings are reviewed for all such cases. The use of steroids or biologics is evaluated and tailored at the surgeon's and gastroenterologist's discretion. A perianal examination is performed to assess the sphincter function, any previous surgical scars, and the presence of perianal diseases. The anal canal is evaluated, and any suspicious lesion for dysplasia or early neoplasia is biopsied, as it may be important for selecting the anastomosis technique. Computed tomography or magnetic resonance imaging may be used for rectal cancer evaluation and anal sphincter involvement, which can be a contraindication to this procedure. If the diagnostic indicators between UC and CD are equivocal, further imaging using CTE/MRE and colonoscopy can be performed. The assessment of anorectal functions with questionnaires and anal manometry is considered useful, if deemed necessary, to determine the sphincter functions.[14] The Cleveland Clinic Fecal Incontinence Score (Wexner Score), the Fecal Incontinence Severity Index, and the Fecal Incontinence Quality of Life Scale are the most commonly used questionnaires for the evaluation of preoperative anal sphincter functions and fecal incontinence.[14-16] Manometry can help determine anal sphincter muscle functions, observe anorectal reflexes, and confirm compliance by measuring the pressure changes during rest and defecation.[17] Mechanical bowel preparation and stoma site marking can be made at the surgeon's discretion. Prophylactic antibiotics should be administered to minimize the chances of postoperative infectious complications, and prophylaxis against deep venous thrombosis should be provided through mechanical methods (e.g., compression devices or stockings) and pharmacological interventions (e.g., low-molecular-weight heparins).

Surgery

The staged approach is the most commonly preferred technique for conducting RP/IPAA, which can be performed as a two-stage (Figure 1) or three-stage procedure. We preferred the three-stage IPAA procedure, which is the total abdominal colectomy with end ileostomy (Figures 2, 3), followed by completion proctectomy with IPAA and diverting loop ileostomy at least 6 months later and ileostomy reversal. Emergency surgery, the use of corticosteroids, or biologics, obesity, malnutrition, and female patients desiring to become pregnant are the appropriate candidates for a three-staged IPAA. The two-stage approach can be performed if the

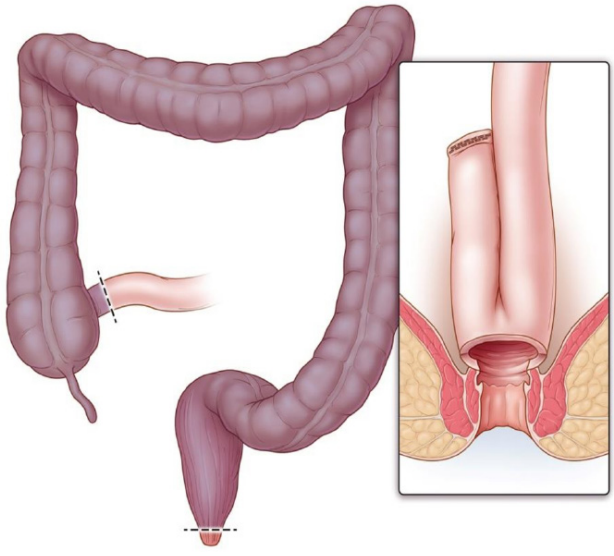

FIG. 1. Restorative proctocolectomy with IPAA.

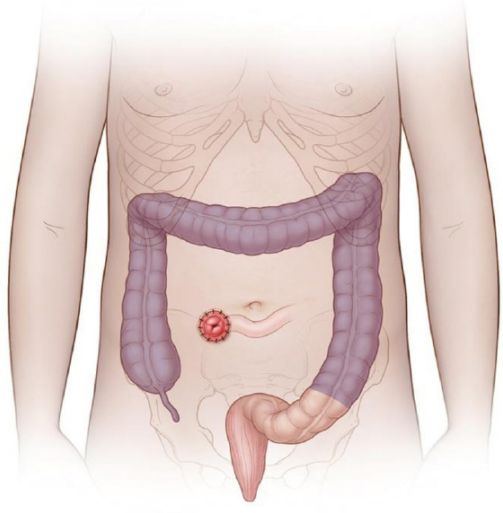

FIG. 2. Subtotal colectomy and end ileostomy.

above factors are absent, which involves total proctocolectomy with IPAA and diverting loop ileostomy, followed by the reversal of the loop ileostomy. One-stage RP/IPAA can be performed in carefully selected patient groups; however, patient factors including malnutrition, the use of steroids or biologics, and anemia can compromise the integrity of IPAA.[18] Avoiding ileostomy may decrease dehydration, bowel obstruction, and complications secondary to ileostomy reversal; however, pouch survival can decrease due to the increased risk of septic complications in patients without diverting ileostomy. For patients with indeterminate colitis, it is recommended to apply a staged approach to pathologically examine the colectomy specimen in order to appropriately manage the disease.

Technique

The ileal PAA can be performed either by adopting the minimally invasive (e.g., laparoscopic or robotic) or the open approach. The type of approach is decided based on the patient's condition, medication use, elective/emergency setting, and the surgeon's preference and expertise.

For total abdominal colectomy with end ileostomy creation, the patient is placed in the Lloyd-Davies position. This procedure begins with the exploration of the abdomen for the presence of any other pathologies. The colon is mobilized free from its lateral attachments, and hepatic, and splenic flexures are removed. Care is taken to preserve the other intra-abdominal structures such as the duodenum, spleen, and ureter. We divided the ileocolic artery at this stage as it allowed the mesentery to lengthen while waiting for stage 2, which may decrease the likelihood of pouch reach issues. The colon is distally divided with a stapler, leaving a rectal cuff sufficiently long to tack to the abdominal wall. We believe that tacking the colon to the abdominal wall facilitates the management of septic complications should they occur without the risk of pelvic sepsis. Furthermore, placing the stump subcutaneously offers several benefits, including the early stabilization of the stump during the second stage of the procedure and minimizing the risk of unwanted adhesions. This technique is advantageous as it allows better wound healing and reduces the risk of complications. In the setting of dysplasia or malignancy, the oncologic principles are followed.

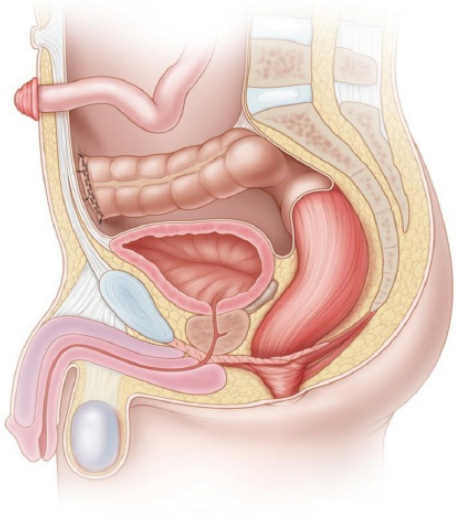

FIG. 3. Rectal stump is shown attached to the fascia.

Laparoscopic colectomy follows the same principles as the open technique. This procedure begins with inserting a Veress needle to create a pneumoperitoneum, after which an 11-mm trocar is placed 2 cm lateral to the umbilicus for the camera. A 12-mm suprapubic trocar and a 5-mm potential ileostomy site trocar are then placed. The abdomen is evaluated for other pathologies, and the abdominal colectomy is performed from the right to the left in standardized steps. A vessel sealer or ultrasonic dissection device should be used for this step. The ileum and colon are transected using a laparoscopic linear stapler, and the specimen is extracted through the suprapubic incision.

Completion proctectomy with IPAA is the second stage of the restorative proctocolectomy. The use of ureteral stents is preferred in cases where the risk of ureteric injury is substantial. Rectal washing out with saline is useful to reduce the risk of superficial surgical site incisions. The lysis of the adhesions around the rectal stump, adherent structures, and other small bowel adhesions is performed through open or minimally invasive techniques. Proctectomy is performed posteriorly in the TME plane, down to the level of the levator ani muscle. Dissection is then performed in the anterior and lateral mesorectal planes to avoid potential nerve injury. The anterior dissection is then performed to the lower border of the prostate gland or the lowest part of the vagina. The Denonvilliers' fascia is preserved in patients without carcinoma. The TME plane is avascular, which minimizes the risk of presacral vein damage. Although there is no supporting evidence, intramesorectal dissection can be associated with long-term functional issues and, subsequently, pouch failure. The rectum should be transected 1-2 cm above the anal transition zone by digital examination.

Pouch creation and anal anastomosis

A successful IPAA requires tension-free pouch anastomosis. Mobilizing the small bowel mesentery to the third part of the duodenum is crucial to allow the ileal pouch to reach the pelvic floor without tension. The Babcock clamp is placed on the apex of the pouch and brought beyond the pubic symphysis to assess the reach. As previously mentioned, the ileocolic artery should be categorized at the origin of the superior mesentery artery at colectomy. In case the tension continues to exist, the peritoneal tissue lateral to the superior mesenteric artery can be excised, followed by incising mesentery along the superior mesenteric artery. If the reach remains an issue, an S pouch can be performed. If an S pouch is not feasible, the pouch can be left in situ and the procedure is finalized through ileostomy creation. It is crucial not to excise the ileal pouch when the reach issue is encountered as mesentery can elongate with time and the patients may need to undergo another procedure to create IPAA.

J pouch

The most common IPAA pouch types are the J or S pouches. The ileum is folded into two 15-20 cm limbs to create the J pouch, and the apex of the pouch is prepared for the anal anastomosis site (Figure 4). At the apex of the pouch, an enterotomy is created, and a side-to-side anastomosis is created by stapling with two fire of 100-mm linear stapler cartridges. The staple lines should be assessed for hemostasis and the sutures should be placed in case of encountering bleeding from the staple lines. A purse-string suture with a 0-polypropylene suture is placed at the enterotomy site and a saline leak test of the pouch is performed before placing the anvil. The majority of the anastomoses are performed with the stapled technique (Figure 5). The stapled technique has been associated with better short-term and functional outcomes when compared to the handsewn technique.[19] Dysplasia or neoplasia at the lower 1/3rd of the rectum requires mucosectomy; therefore, handsewn anastomosis is preferred in such cases. Either the double- or single-stapling technique can be used for construction. In the former, the distal anorectal stump is closed with the firing of a linear stapler, and the specimen is separated. The linear staple line on the anorectum should be at the level immediately below the superior border of the anus. Then, a circular stapler shaft is inserted into the anus and then paired with the anvil shaft emerging from the ileal pouch (Figure 6). Before stapling, any twisting of the small bowel mesentery, vaginal wall, and anal sphincter should be examined and prevented.

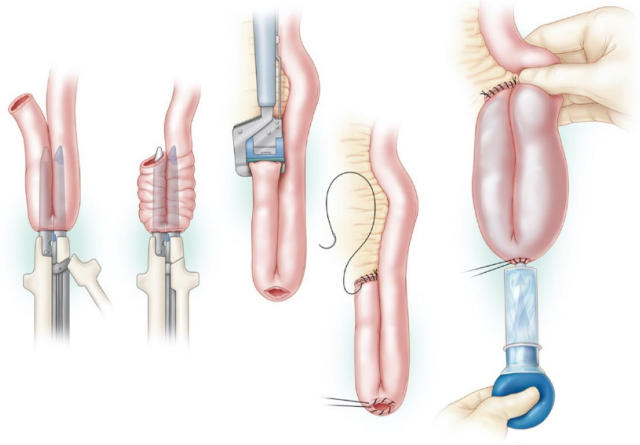

FIG. 4. Creation of the ileal pouch and saline leak test.

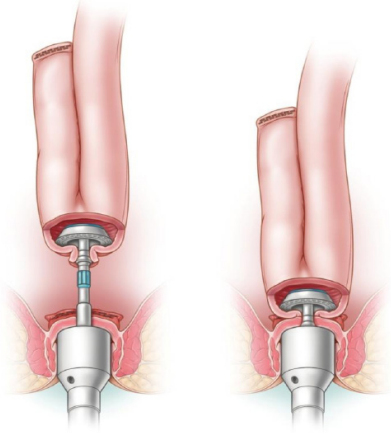

FIG. 5. Double-stapled pouch-anal anastomosis.

S pouch

An S pouch is an alternative to the J pouch, especially when there is a reach issue of a J pouch to the pelvis as it provides 2-4 cm of additional reach without excessive tension in the IPAA (Figure 7). Three limbs of 12-15 cm of the ileum with a 2 cm exit conduit are used to create an S-pouch. The limbs are attached with continuous seromuscular sutures. An S-shaped enterotomy is then performed, and the posterior anastomotic lines are sewn with continuous full-thickness sutures. The anterior wall of the anastomosis is also closed with seromuscular sutures by using 3-0 Vicryl.

H pouch

An H pouch is mainly used for redo pouches. It is constructed if tension-free anastomosis is technically not feasible. If the J pouch creation is technically feasible, but has no adequate mesenteric length; its apex is opened with sharp dissection, allowing the afferent limb to reach a further 2-3 cm. The efferent limb of the J pouch, which is the distal portion of the ileum, is stapled at both ends, and the staple lines are sewn with a continuous 3-0 Vicryl suture. An enterotomy is created in each limb at the halfway point (Figure 8). A linear stapler is run on the cephalad and caudad to create the pouch. Finally, the enterotomy is closed with a continuous 3-0 vicryl suture.

Creation of a diverting loop ileostomy

A temporary diverting loop ileostomy is matured from 20 to 25 cm proximal to the pouch inlet after IPAA is performed (Figure 9). If tension-free reaching of the ileal loop is not possible for the abdominal wall, a divided end ileostomy may be considered. Based on the surgeon's preference, the closed suction drain may be placed into the presacral space, after which the incision is closed.

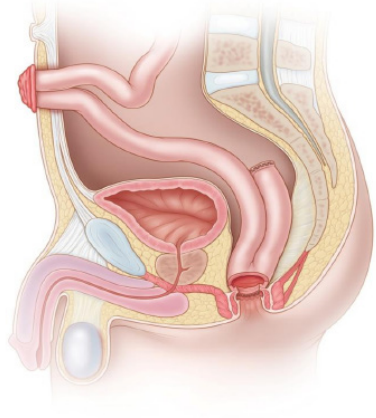

FIG. 6. Anatomy after IPAA.

Technique for handsewn anastomosis

Mucosectomy is performed before handsewn anastomosis. The mucosa is removed from the dentate line up to the level of the anorectal junction. The sutures for everting anal verge are placed in the four quadrants and an anal retractor is then passed. An adrenaline solution is then injected to separate the mucosa from the underlying muscles. The removal of the mucosa is performed through electrocautery. Extreme stretching of the anal canal is avoided to prevent damage to the anal sphincters. Then, 2-0 polyglycolic acid sutures are placed on the dentate line radially, involving the internal anal sphincter fibers. In a female patient, anterior sutures are not placed deeply so as to minimize the risk of vaginal inclusion. After the pouch is brought down to the anal verge, the sutures previously placed at the dentate line are now passed through the apex of the J-pouch or the end of the exit conduit of the S-pouch. Finally, the retractor is removed, and the sutures are tied.

Minimally Invasive Approaches

Laparoscopic surgery

The main technical steps of open, laparoscopic, or robotic approaches are similar. In light of recent studies, laparoscopic completion proctectomy, and IPAA is technically safe and feasible.[19] Laparoscopic completion proctectomy and IPAA offer diminished postoperative pain, reduced analgesia requirements, and shorter hospital stays when compared to the open technique.[20,21] Moreover, a laparoscopic IPAA may reduce infertility in female patients.[22]

In the second stage of the surgery, laparoscopic exploration is performed, and the lysis of the adhesions is performed if required. A subcutaneously placed rectal stump is then released, and mesorectal dissection is conducted to the pelvic floor, followed by transection of the rectum by using a linear stapler. After the extraction of the specimen through the suprapubic incision, a J-pouch can be created extracorporeally in the standard fashion and then repositioned to the abdomen in order to construct a a pouch-anal anastomosis laparoscopically after re-establishing the pneumoperitoneum.

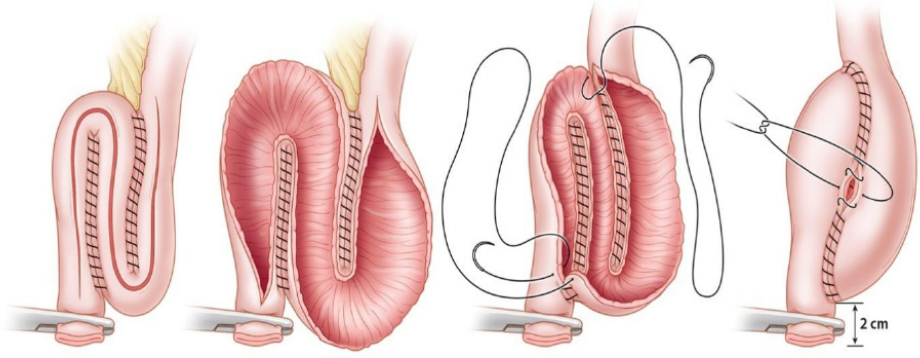

FIG. 7. S-pouch can provide an additional 2-4 cm reach without any excessive tension in the IPAA.

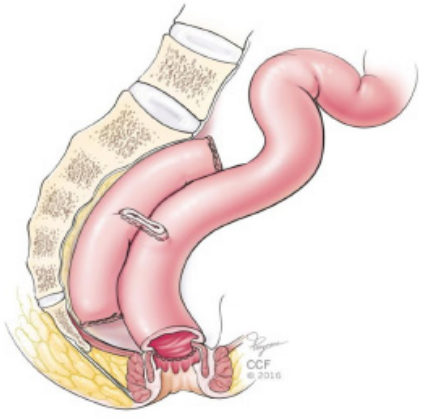

FIG. 8. H-pouch design.

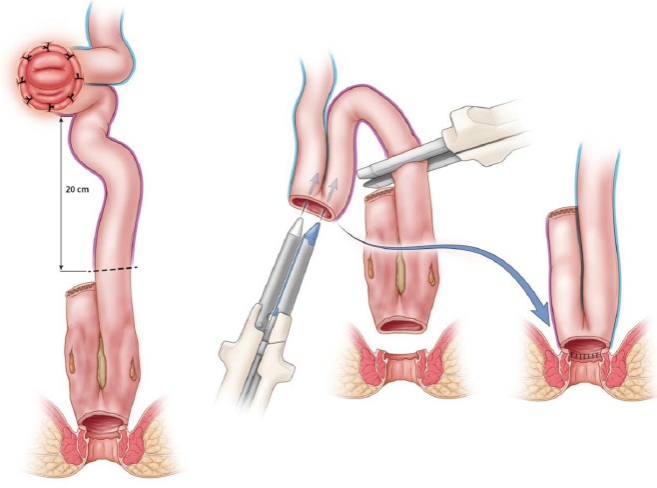

FIG. 9. Creation of a thoughtful ileostomy.

Robotic surgery

Laparoscopy may be challenging in patients with a high body mass index or deep and narrow pelvis.[23] Robotic surgery may overcome the limitations of laparoscopy. The use of a robotic stapler is beneficial owing to its articulating ability, forming a crucial part of completing the robotic proctocolectomy and IPAA procedure.[24] Low-level rectal transactions can be achieved in a deep and narrow pelvis, especially in male patients.[24]

During robotic proctocolectomy, 5 robotic trocars (four 8-mm and one 12-mm) extending from the right iliac fossa to the left upper quadrant and two 5-mm assistant trocars in the suprapubic area and right upper quadrant are used. After docking, the first step of the total proctocolectomy procedure is the right-sided dissection of the colon. The preferred approaches during this surgery are the medial-to-lateral mesenteric dissection and central ligation of the ileocolic and middle colic vessels. The release of the transverse colon, followed by splenic flexure mobilization, is the subsequent stage of right-sided dissection. Next, robotic instruments are repositioned from the right to the left of the patient. Dividing the inferior mesenteric vessels, the dissection of the left colon mesentery in a medial to the lateral manner, and the preservation of the critical anatomic structures such as the ureter, gonadal vessels, and autonomic nerves are crucial, followed by the pelvic dissection and mobilization of the rectum and mesorectum. Using the robot's ability, the surgeon changes the angle of the robotic camera from a down to an up position to examine the intersphincteric area and the levator ani muscles.[24] Then, the rectum is transected using an articulating robotic linear stapler. The specimen is extracted through the suprapubic incision, extracorporeally creation of the J-pouch is performed, and a pouch-anal anastomosis is constructed, followed by the creation of the diverting loop ileostomy.

Long-term outcomes

In experienced centers, over 95% of the patients become stoma-free in 10 years.[25] IPAA aims to improve the quality of life and is, in fact, associated with excellent quality of life. Over 95% of the patients with IPAA undergo the same procedure if required.[26,27] However, it is important to set expectations for the patients before the procedure, as the majority of the patients have 3-8 bowel movements a day and approximately 10-20% of them have incontinence-related issues.

IPAA is a complex procedure and there are well-established complications after pouch surgery. One of the most common complications of IPAA is pouchitis, which affects 44% of all patients after 10 years of surgery.[28] The characteristic feature of pouchitis is the presence of crampy lower abdominal pain, increased stool frequency, and general malaise.[29,30] It is suggested that this complication commonly occurs within the first year of pouch creation and that its first episode typically occurs closely after the reversal of the ileostomy.[31,32] Pouchitis can be classified as acute pouchitis or chronic-relapsing pouchitis. A combined evaluation of pouch inflammation is therefore required for appropriate diagnosis, which considers clinical symptoms, endoscopic assessments of the pouch, and histopathology from pouch biopsies.[33] The pouchitis severity can be assessed with the scoring systems, of which the best-known one is the pouch activity index.[34-36] The treatment of pouchitis is based on the elimination of bacterial dysbiosis, which is commonly treated with ciprofloxacin or metronidazole.[37,38] Probiotic bacteria without or with antibiotics to fix the pouch flora can be helpful, especially in the management of chronic pouchitis.[37]

Pelvic sepsis, which can present as pouch fistula/sinus, anastomotic stricture, and poor function of the pouch is estimated to complicate 10-20% of all cases of IPAAs.[39] The 3 types of pouch fistulas are pouch-anal, pouch-vaginal, and pouch-perineal. Pouch fistulae commonly present with discharge from its penetrated area. This presentation and radiological screening with a contrast enema are used for the diagnosis of pouch fistulae. The treatment of pouch fistula depends on the severity of the symptoms. Seton placement may be sufficient for patients showing minimal symptoms; however, for patients who experience symptoms such as incontinence, proximal diversion with an ileostomy should be performed if not already present. Irrespective of the symptom severity, the inflammatory area should be adequately drained before undertaking the fistula repair process.[40]

The 10-year risk of pouch failure is approximately 6%.[41] The most common cause of pouch failure is pelvic sepsis, followed by mechanical factors such as pouch twist, long rectum/mesorectum, Crohn's of the pouch, chronic antibiotic refractory pouchitis, and dysplasia/neoplasia.[41] When a patient requires the management of pouch failure, the pouch can be revised or excised through the permanent ileostomy. Although pouch excision is performed more commonly in such cases, the short-term postoperative outcomes between pouch revision and excision are comparable. In terms of short-term morbidity and mortality, patients can be reassured that these procedures are similar.[42] Patient selection and setting the expectations preoperatively is therefore crucial during a redo IPA, as it is technically more complex and associated with relatively worse outcomes than that for primary IPAA. However, at experienced centers, long-term stoma-free survival can be achieved in 85% of the patients.[43]

The rate of IPAA patients affected by anastomotic stricture is reportedly 14% and the stricture is usually associated with undue tension of the anastomosis and local ischemia.[40] The key step to avoid stricture formation is minimizing the traction on the reservoir with full mobilization. The management of pouch-anal strictures should be conducted step-wise as conservative procedures are often associated with acceptable success rates. Using bougie or Hegar dilation for mechanical dilatation has a > 80% success rate; however, it may require repeated dilations.[44] If this therapy fails, depending on the location, and length of the stricture, it can be treated with resection, strictureplasty, or bypass. Pouch revision and re-anastomosis are the treatment choices for mid-pouch strictures.[44] In terms of the IPAA-creation technique, lower rates of stricture have been recorded with stapled anastomosis when compared to that handsewn anastomosis.[45,46]

Surgical procedure techniques also affect the complication rates; however, no significant difference was detected between 2 and 3 stages of IPAA surgery procedures in terms of perioperative complications such as pouchitis, fistula, or abscess, incisional hernia, anal stricture, and pouch failure.[47] In addition, the number of bowel movements per day was found to be similar, with no difference observed in relation to depression, treatment for pouchitis, sexual satisfaction, or erectile dysfunction.[47]

In addition, there were no differences observed in the early and late outcomes (especially for pouch function) among UC patients who had undergone laparoscopic or traditional surgery.[48] Handsewn IPAA results in worse long-term functional outcomes and QoL when compared to stapled IPAA, which is considered safer in terms of complications.[20] FAP patients can have different postoperative problems, such as adenoma development. Pouch adenomas are more frequently observed in patients with gastric or duodenal adenomas than in those who did not have these previously.[49]

Moreover, as per a past report, several patients who underwent IPAA surgery required additional surgical interventions due to indications such as nonhealing perineal wounds, revision of the stoma, and symptomatic parastomal, or ventral hernias.[50]

The majority of long-term complications can be prevented with comprehensive preoperative evaluation and by using proper surgery techniques and postoperative care at experienced centers under the guidance of experts. All complications, especially the most common ones, including pouch failure, pouchitis, fistula, stricture, and incisional hernia should be carefully investigated at each center to determine the reasons so as to protect patients. The patients should be referred to centers experienced in managing pouch-related complications.

IPAA is the standard of care for patients requiring colectomy for UC and can be performed in selective patients with CD and FAP. The long-term stoma-free survival rates after IPAA are approximately 95% in experienced centers. Comprehensive preoperative evaluation and appropriate postoperative care are associated with increased rates of pouch survival. Moreover, IPAA is associated with a good quality of life and acceptable functional outcomes. Patients should therefore be evaluated in specialized centers for pouch-related complications. Redo IPAA is also a good alternative in case of IPAA failure.

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