Technical Aspects of Ileoanal Pouch Surgery

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ABSTRACT

Ileal pouch-anal anastomosis has become the surgical procedure of choice for chronic ulcerative colitis. Since the initial description of the technique, various modifications have facilitated its evolution into a safe operation with excellent long-term outcomes. However, some aspects of the operation remain contentious. Our aim is to describe the technical aspects of ileal pouch-anal anastomosis and review the current literature in the areas of controversy.

KEYWORDS: Ileoanal pouch, ulcerative colitis, surgery

Objectives: Upon completion of this article, the reader should be able to describe the technique of ileal pouch-anal anastomosis and summarize the variations and controversies that exist.

In appropriately selected patients, ileal pouch-anal anastomosis (IPAA) has become the surgical procedure of choice in the treatment of ulcerative colitis.¹ IPAA removes the diseased large bowel, eliminates the need for a permanent stoma, and provides a good functional outcome and quality of life.¹⁻³ Since it was first described in 1978,⁴ the technique of IPAA has evolved so it can be performed with low morbidity and good long-term outcomes.^{1,5} The quality of life for these patients is also improved when compared with that of a Brooke ileostomy or continent Koch ileostomy.^{2,3} Our aim is to review the technical aspects of IPAA 25 years since its original description.

INDICATIONS FOR IPAA

IPAA is performed as an elective procedure. Medical therapy may have failed, or the complications of such therapy outweigh the anticipated benefits. Extraintestinal manifestations, especially thromboembolic complications, erythema nodosum, and arthralgias of the small

and large joints, may also be an indication for surgical intervention.⁶ A further indication for IPAA is the presence of dysplasia, a dysplasia-associated lesion or mass, or frank malignancy. The presence of colon cancer does not preclude IPAA; however, adherence to traditional standards of oncological resection must be maintained. In the setting of an associated advanced mid or low rectal cancer, IPAA may be contraindicated when adequate oncological surgery will damage the anal sphincter mechanism, or the need for adjuvant therapy will adversely affect pouch and anal sphincter function.⁷ Clearly, all patients should have an intact and functioning anal sphincter prior to consideration of IPAA.

Although increasing age is not an absolute contraindication to IPAA, older patients may have more frequent nocturnal pouch evacuations and episodes of incontinence.^{1,8} Appropriate patient selection is important to maximize the benefits of IPAA while minimizing the potential for poor functional outcomes.^{1,8}

Preoperatively, the risks, benefits, and alternatives are discussed in detail with patients to enable them to

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make an informed decision about their surgery. Written information is also provided. Preoperative consultation with an enterostomal therapist is essential.

OVERVIEW OF THE OPERATION

A standard mechanical and antibiotic bowel preparation is used. The patient is placed in the Lloyd-Davies position and the abdomen explored through a midline incision. Colectomy is performed first, with preservation of the ileocolic pedicle. The ileum is transected immediately proximal to the cecum. We also preserve the omentum if possible. Omentectomy appears to have no impact on the incidence of postoperative small bowel obstruction and may increase the rate of abdominopelvic sepsis.⁹

At Mayo the underlying pathological diagnosis of ulcerative colitis is confirmed by frozen section prior to completion of the IPAA. Once Crohn's disease is excluded, construction of an ileal reservoir from the terminal 30 to 40 cm of ileum is performed. Whether hand-sewn or stapled, great care is taken to ensure that surrounding tissues are not incorporated into the anastomosis, especially the posterior vaginal wall. A temporary diverting loop ileostomy is usually used to protect the ileal pouch. This is closed ~12 weeks later after a pouchogram and anorectal manometry have been performed.

Over the years since its introduction, the technique of IPAA has been refined. There are, however, several ongoing areas of controversy with regard to some technical aspects.

PROCTECTOMY

Avoiding injury to the pelvic autonomic nerves is of paramount importance when performing proctectomy; the patient group undergoing the procedure is usually young and preservation of sexual function is clearly mandatory. Both close rectal and mesorectal dissections are described.^{4,10} The benefit of close rectal dissection may be a reduction in nerve injury rates. However, dissection in this plane is less straightforward as it is not the bloodless plane encountered during a mesorectal dissection. A close mesorectal dissection of the upper rectum may protect the hypogastric nerves and reduce the incidence of retrograde ejaculation.¹¹ However, nerve injury leading to impotence is sustained during the anterolateral dissection of the rectum; dissection of this region is similar in both techniques.¹² We perform proctectomy in the mesorectal plane and remain posterior to Denonvilliers fascia when dissecting the anterior rectum.

Sharp dissection of the mesorectum is used while firm traction on the rectum is maintained. Waldeyer's fascia is incised with electrocautery or scissors. At S3, the anterior right-angle turn of the rectum must be kept in mind to avoid inadvertent posterior dissection into the presacral tissue. Mobilization is continued until the

coccyx is palpable posteriorly and complete circumferential mobilization of the rectum is obtained to the level of the levators. Direct visualization of the seminal vesicles and most of the vagina should be possible. In the obese patient or the patient with a narrow pelvis, an assistant placing inward pressure on the perineum may make the distal dissection easier. Adequate distal mobilization of the rectum is confirmed by placing the index finger in the anal canal to assess the proposed level of transection.

MUCOSECTOMY VERSUS DOUBLE-STAPLED TECHNIQUE

The aim of IPAA is to remove all of the diseased colonic and rectal mucosa, eliminating the risk of recurrent mucosal disease and the possibility of neoplastic transformation. The double-stapled technique leaves a cuff of anal transition zone (ATZ) to which the pouch is anastomosed; residual columnar mucosa is usually present in this cuff.¹³ Anastomosis at this level will give better function than an anastomosis at the dentate line.¹⁴ Mucosectomy will remove most of the rectal mucosa,¹⁵ but may be associated with poorer function outcomes. Thus there is debate over the trade-off between the improved function with the stapled technique, leaving some residual mucosa and the inherent risks of this (malignancy and recurrent inflammation, or "cuffitis"), versus mucosectomy, where, at least theoretically but perhaps not actually, all rectal mucosa is removed. Poorer function with mucosectomy may be due to a combination of mechanical trauma to the anal sphincter during the dissection and removal of the ATZ.

Ten-year follow-up of the double-stapled technique has shown the incidence of dysplasia in the residual ATZ to be 4.5%.¹⁶ While there have been reports of cancer developing following IPAA, these have occurred after mucosectomy¹⁷⁻¹⁹ as well as with the use of the double-stapled technique.^{20,21} Indeed, we have shown that residual islands of rectal mucosa may remain at the ileoanal anastomosis in up to 7% of patients after mucosectomy.¹⁵ Persistent dysplasia of the ATZ may require excision of this segment, using either a combined abdominoperineal approach or a transanal mucosectomy with ileal pouch advancement.²²

In a prospective randomized trial, we have shown that there is improved fecal continence at night when a double-stapled technique is used to construct the J pouch-anal anastomosis; 64% of the hand-sewn group experienced occasional or frequent episodes of incontinence compared with 38% of the stapled group.²³ Higher anal-canal resting pressures (49.4 vs 78.3 mm Hg; $p < 0.05$) and squeeze pressures (144 vs 195 mm Hg; $p < 0.06$) were also found when the stapled technique was used. These findings have also been supported by another randomized trial.²⁴ In contrast, two randomized trials

have found no difference in function between the double-stapled technique and mucosectomy.^{25,26}

A retrospective study of 692 patients has suggested an increase in early septic complications when a mucosectomy with hand-sewn IPAA was used,²⁷ but these results have not been supported by randomized trials.^{23–26}

A further modification of the IPAA is the use of the single-stapled technique, with a per anal purse-string placed at the top of the anal canal. Theoretically this allows mucosectomy to be performed while maintaining the advantages of the circular stapling technique.²⁸

The most important decision to make in determining whether to perform a stapled or hand-sewn anastomosis with mucosectomy is what is safest and best for the patient. In the presence of mucosal neoplastic change, mucosectomy should be performed. Indeed, our preference is to use the double-stapled technique unless such change is present. This is supplemented by yearly follow-up of the ATZ with digital examination and endoscopy with biopsy.

POUCH DESIGN

The initial report of IPAA described a hand-sewn pouch with an “S” configuration.⁴ The combination of ingenious thinking and the use of stapling techniques have led to a multitude of options for constructing pouches. These include the J,²⁹ W,³⁰ K,³¹ H,³² B,³³ and U.³⁴ While stool frequency was 3.7 per day, evacuation problems with the S pouch, leading to the need for pouch intubation in up to 50% of patients, have curtailed the widespread use of this configuration.³⁰ A long efferent limb, the most likely causative factor of evacuation problems,³⁵ has subsequently been shortened (by 2 to 3 cm) to try to reduce the incidence of this complication. In patients with an S pouch and evacuation problems, IPAA revision with shortening of the efferent limb of the pouch may be performed.

Manovolumetric studies have shown that S pouches have a greater median volume than J pouches (420 mL vs 305 mL), though there was no difference in function between either configuration or that of the K pouch.³¹ One advantage of the S pouch is an extra couple of centimeters in length compared with other pouch configurations; this may be important when there are concerns about the ability to perform a tension-free IPAA.³⁶ To attempt to overcome the evacuation problems associated with the S pouch, the J and W pouches have been subsequently described.

The W pouch was proposed by Nicholls and Pezim in 1985,³⁰ the potential advantages being a lower frequency of defecation and no requirement for pouch intubation. An inverse relationship between pouch volume and stool frequency was also found when the S, J, and W pouches were compared.³⁰ Technically, the W

pouch was found to be no more difficult to construct, though it was more time-consuming. The bulkier nature of the pouch may also result in difficulties placing the pouch in a narrow pelvis. Fifty cm of ileum, the same length required for an S pouch, was required, compared with 30 to 40 cm for a J pouch. In a study of 64 W pouches, the 24-hour stool frequency rate was 3.3, with night-time evacuations in 14% and normal continence being described in 92%.¹¹ Manovolumetric studies have also shown that W pouches have greater maximum tolerated volumes, greater compliance, and greater efficiency of evacuation when compared with S pouches.³⁷

The J pouch is technically easy to construct and results in good function without the need for pouch intubation. The pouch may be constructed via an enterotomy at the apex of the pouch or through enterotomies made in the body of the pouch.¹⁰ We use the linear stapler-cutter to construct the pouch, though it may be hand-sewn. When using the stapling device placed through enterotomies in the body of the pouch, it is important to check the segment of the pouch where the staple lines overlap, and to oversee any regions that have not been anastomosed by the stapler, or else anastomotic leakage will occur. The septum of tissue at the apex of the pouch that usually remains with this technique also must be divided with a stapler. It is also important to check for staple-line bleeding prior to construction of the IPAA. We also secure the terminal “ear” of ileum that is not incorporated into the long staple-line to the inflow tract to avoid potential “blow-out” of the pouch.

Four randomized trials comparing J and W pouches have been published. Two trials, one of 60 and one of 33 patients, have shown no difference in function between J and W pouches at up to 12 months of follow-up.^{38,39} A further trial of 24 patients showed a mean daily defecation frequency of 3 in W pouches and 5 in J pouches at 12 months.⁴⁰ In this study, the W pouch was also associated with significantly less night-time defecation and significantly less antidiarrheal usage. A further trial of 50 patients, published as an abstract only, showed a reduction in average 24-hour stool frequency at 12 months with a W pouch (5 vs 7.8 with J pouch).⁴¹ It should be noted that the stool frequency in the J-pouch group was high compared with other large published series where long-term follow-up shows a median stool frequency per day of 6 in males and 7 in females.¹

Most studies comparing pouches have not considered factors apart from pouch design that may alter function. Factors such as sphincter function, stool consistency, patterns of motility, and capacity of the pelvis to accommodate the pouch must be considered. Using about 30 to 40 cm of terminal ileum probably results in little functional difference regardless of pouch configuration. Given the ease of construction and comparable functional outcomes, we favor the J pouch at Mayo.

ACHIEVING LENGTH

In some patients it may be difficult to obtain enough length of the small intestine to allow a tension-free anastomosis with the anal canal. The apex of the pouch should reach the inferior border of the pubic symphysis to allow a tension-free IPAA.¹⁰ Several maneuvers may be used to obtain extra length. Initially, division of the terminal ileum should be performed within 2 to 3 cm of the cecum.³⁶ All adhesions should be divided and mobilization of the terminal ileal mesentery to the level of the duodenum should be performed.¹⁰ Division of the peritoneum on both sides of the mesentery will also result in further length being obtained. When the proposed apex of the pouch is established, a further assessment of tension can be made by a trial placement of the proposed pouch apex to the level of the pubic symphysis, or into the pelvis to the top of the anal canal.

Division of either the terminal divisions of the superior mesenteric artery (SMA) or the ileocolic artery (IC) can be performed to further reduce tension and provide extra length, providing that the vascularity of the ileum is confirmed. Clamping of the vessels for at least 15 minutes prior to ligation of the SMA branches is recommended.^{36,42} IC division alone will provide an extra 3 to 7 cm of length. It has been reported that high division of the SMA pedicle (at the level of the last jejunal branches) can be performed safely without impact on complication rates or functional outcomes, but we do not practice this maneuver and would advise extreme caution if considering it.⁴² A cadaveric study has shown that the distal third of both the SMA and the IC artery can be divided to obtain extra length if the marginal artery from the middle colic artery to the IC artery is preserved.⁴³ In practice this maneuver is rarely, if ever, required. The use of an S pouch may result in an additional gain of 2 to 3 cm,³⁶ but problems with functional outcome limit the use of this configuration.³⁰

In our experience it is uncommon for length to be a problem after division of all adhesions, full mobilization of the ileal mesentery, incision of the anterior and posterior peritoneum, and division of the IC. In a series from the Mayo clinic,⁴⁴ inability to make the pouch reach the anus or pouch ischemia after lengthening maneuvers were the reasons for the intraoperative abandonment of IPAA in 32 of 74 patients in whom the pouch could not be constructed.

THE ROLE OF A DEFUNCTING ILEOSTOMY

Sepsis, both pelvic and intra-abdominal, following IPAA is clearly a complication that is best avoided. At the Mayo Clinic, pelvic sepsis occurs in 4.8% of patients undergoing IPAA.⁴⁵ In a study of 73 patients with pelvic sepsis, the pouch failure rate (permanent diversion or pouch excision) was 26%, compared with 5.9% in

patients without this complication.⁴⁵ Furthermore, while pouch evacuation rates were similar, incontinence rates, need to use protective pads, and medication usage were all higher in the group of patients with pelvic sepsis.⁴⁵ Significant lifestyle restrictions also occurred more frequently.⁴⁵ Aside from the longer-term poorer functional outcomes, sepsis may also be life threatening.⁴⁶

The use of a defunctioning ileostomy may help to reduce the incidence of pelvic sepsis; however, formation of an ileostomy is associated with its own set of potential complications. Mechanical and functional complications may follow construction and closure of the stoma. In an early series of 157 temporary loop ileostomies at the Mayo Clinic,⁴⁷ mechanical complications occurred in 39 patients (retraction, 15.9%; prolapse, 1.3%; fistula, 0.6%; abscess, 0.6%; bowel obstruction related to stoma, 6.4%). Functional complications occurred in 111 patients (peristomal irritation, 53.5%; leakage, 7.6%; high output, 3.8%; incomplete diversion, 5.7%). Following stoma closure, bowel obstruction occurred in 14.7%, peritonitis in 7.4%, and wound infections in 1.6%.

Omitting a loop ileostomy has the attractive advantages of requiring only one hospital admission and avoiding the potential complications of ileostomy closure. There is also a financial advantage to a single-stage procedure.⁴⁸ Several series have reported equivalent outcomes with and without the use of temporary diversion.⁴⁹⁻⁵¹ At Mayo a very early series in which 37 patients undergoing single-stage IPAA without a defunctioning ileostomy were compared with a case-matched group of 37 patients who had had an IPAA performed with defunctioning ileostomy.⁴⁸ There was no statistical difference in the complication rates or in the number of patients requiring reoperation between the group with ileostomy and the group without ileostomy. Functional outcomes were also similar in both groups. The single-stage procedure appeared to be a reasonable option in a select group of patients who are in good health, who are not on chronic steroid therapy, and who have an absolutely tension-free anastomosis constructed. These conclusions were supported by a randomized trial in 1992 by Grobler and colleagues.⁵² In this trial, 23 patients had IPAA with loop ileostomy and 22 had IPAA without loop ileostomy, no patients were taking steroids, all operations had an uncomplicated intraoperative phase, and all were double-stapled J pouches. There were no statistically significant differences in postoperative complication rates or in pouch function.⁵²

The complications of ileostomy construction and closure must be balanced against the risks and complications of pelvic sepsis. Importantly, constructing a loop ileostomy does not prevent an anastomotic or suture line leak from occurring. If a leak does occur, however, it is more desirable to have a diverting ileostomy in place and have to manage the potential complications of a loop ileostomy than try to manage the complications of

overwhelming sepsis. Therefore, only rarely do we omit a defunctioning ileostomy, and only when circumstances are favorable as previously described. Three months following IPAA, after a satisfactory water-soluble contrast pouch study is performed, the ileostomy is closed.

LAPAROSCOPIC IPAA

Laparoscopic restorative proctocolectomy with IPAA is performed using the same principles as the open procedure. At Mayo, a simplified technique has been developed to try to reduce the potential technical problems associated with laparoscopic approach (Hahnloser et al, unpublished data, 2003). A four-port technique, with extracorporeal mesenteric vascular ligation and J-pouch construction through a 4 to 5 cm periumbilical incision is currently used. Absolute contraindications for laparoscopic IPAA include pregnancy and the need for emergent colectomy. Relative contraindications are previous intra-abdominal surgery with multiple intra-abdominal adhesions and obesity.

Our early experience with laparoscopic IPAA has been reported.⁵³ Seven patients undergoing laparoscopic IPAA were compared with seven case-matched controls undergoing conventional open IPAA. Significant reductions in intravenous narcotic use, time to resumption of regular diet (2 vs 7 days; $p = 0.010$), and length of hospital stay (4 vs 9 days; $p = 0.012$) were found. Complication rates were the same in both groups. Operating times were significantly longer with the laparoscopic approach (median 340 vs 237 minutes; $p = 0.013$); however, with experience, operating times have diminished, with most procedures now requiring ~3 hours.

Other studies have also confirmed earlier resumption of normal bowel function and reductions in length of hospital stay.^{54,55} In contrast, Schmitt and associates have suggested that there is no reduction in ileus or postoperative length of stay with laparoscopic IPAA.⁵⁶ Technical variations may explain these differences as proctectomy was performed through a Pfannenstiel incision in this study.⁵⁶ Functional outcomes and quality of life following laparoscopic IPAA appear to be no different from the open procedure.⁵⁵ Patient satisfaction with the cosmetic result following surgery is higher after laparoscopic IPAA.⁵⁵

A further advantage of laparoscopic IPAA may be a reduction in adhesion formation and the subsequent potential complications they may produce.^{57,58} Following laparotomy and IPAA, 17% of patients may experience an episode of small bowel obstruction, 7.5% of whom may require surgical intervention.⁵⁹ The cumulative risk of small bowel obstruction following IPAA at 10 years has been shown to be as high as 31.4%.⁶⁰

IPAA performed for ulcerative colitis reduces female fertility.⁶¹ While there are many possible etiological factors which may contribute to this reduction in

fertility, the development of pelvic adhesions may be important. Reduction in adhesion formation using laparoscopic IPAA may theoretically assist in reduction of this problem. The potential advantage of laparoscopic IPAA in reducing adhesions requires further investigation and is the subject of a current study.

CONCLUSION

Ileal pouch-anal anastomosis has evolved over the 25 years since its introduction; it is now the procedure of choice for patients requiring proctocolectomy for chronic ulcerative colitis. The prospect of good long-term functional outcomes allows patients to choose between a permanent ileostomy and ileal pouch-anal anastomosis. Over time, several technical developments and controversies have emerged, some of which are still contentious. As the coming decades unfold, further refinements in the procedure will no doubt occur, and some of the current dilemmas will be resolved.

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