

State of the Art: Pouch Surgery in the 21st Century

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BACKGROUND: An ileoanal pouch with IPAA is the preferred method to restore intestinal continuity in patients who require a total proctocolectomy. Pouch surgery has evolved during the past decades thanks to increased experience and research, changes in the medical management of patients who require an ileal pouch, and technological innovations.

OBJECTIVE: To review the main changes in pouch surgery over the past 2 decades, with a focus on staging, minimally invasive and transanal approaches, pouch design, and anastomotic configuration.

RESULTS: The decision on the staging approach depends on the patient's conditions, their indication for surgery, and the risk of anastomotic leak. A minimally invasive approach should be performed whenever feasible, but open surgery still has a role in this technically demanding operation. Transanal IPAA may be performed in experienced centers and may reduce conversion to open surgery in the hostile pelvis. The J-pouch is the easiest, fastest, and most commonly performed design, but other designs may be used when a J-pouch is not feasible. A stapled anastomosis without mucosectomy can be safely performed in the majority of cases, with a low incidence of rectal cuff neoplasia and better functional outcomes than handsewn. Finally, Crohn's disease is not an absolute contraindication to an ileoanal pouch, but pouch failure may be higher compared to other indications.

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CONCLUSIONS: Many technical nuances contribute to the success of an ileoanal pouch. The current standard of care is a laparoscopic J-pouch with double-stapled anastomosis, but this should not be seen as a dogma, and the optimal approach and design should be tailored to each patient. **See video from symposium.**



KEY WORDS: Crohn's disease; Familial adenomatous polyposis; Handsewn anastomosis; Ileal pouch; Ileoanal pouch; J-pouch; Laparoscopic IPAA; Mucosectomy; Robotic IPAA; Stapled anastomosis; Transanal IPAA; Ulcerative colitis.

Since it was first described by Parks and Nicholls in 1978,¹ the construction of an ileal reservoir (the “ileal pouch”) with IPAA remains the preferred method to restore intestinal continuity in patients who require a total proctocolectomy (TPC).

Increased experience and research, changes in the medical management of patients who require an ileal pouch, and technological innovations have contributed to the evolution of pouch surgery during the past decades. The goal of pouch surgery is a technically feasible and standardized operation with low morbidity that leads to a pouch that empties well, with an acceptable number of bowel movements, sustained good long-term function, avoidance of permanent ileostomy, and low or no detrimental impact on the patient's quality of life.

The procedure has become more standardized with time, with most pouches being constructed with a J configuration and stapled anastomosis. The introduction of biologics for the treatment of IBD has changed the natural history of ulcerative colitis (UC) and Crohn's disease (CD), with fewer patients requiring surgery but with patients who do require surgery usually being sicker. Technological advances, such as laparoscopy, robotics, and transanal minimally invasive approaches, have impacted pouch surgery just as the rest of the colorectal field.

In this review, we explore the main changes in pouch surgery over the past 2 decades, with a focus on staging, minimally invasive (MI) and transanal approaches, pouch design, and anastomotic configuration, and we provide recommendations on the optimal current pouch surgery.

STAGED VERSUS NONSTAGED IPAA

The IPAA can be performed as a 1-stage, 2-stage, modified 2-stage, or 3-stage procedure, as described in Table 1. Conventional 2-stage and 3-stage IPAA are the approaches that have been used longer and are usually considered the safest alternatives. Conversely, the 1-stage and modified 2-stage IPAA do not involve the formation of a diverting loop ileostomy (DLI) at the time of IPAA creation.

Historical Perspective

The attitude of colorectal surgeons with regard to staging approaches has evolved over time. Parks and Nicholls first described a 2-stage procedure (ie, TPC with IPAA and diverting ileostomy, followed by ileostomy reversal). The rationale behind a diverting ileostomy is to avoid or minimize the dreadful clinical consequences of an undiverted anastomotic leak, which can occur in 5% to 15% of cases.^{2,3} During the 90s, the need for an ileostomy started to be challenged because the ileostomy did not necessarily diminish the risk of developing an anastomotic leak⁴ but had inherent stoma-related risks (eg, high output, dehydration, complications at stoma reversal) and was

associated with increased rates of anastomotic stricture and late complications.⁵ As acceptable outcomes were observed in patients who underwent single-stage IPAA,^{6,7} its utilization became more prominent.

In the pioneering age of pouch surgery and for many decades thereafter, the mainstay therapy for IBD had been steroid-based. The introduction of anti-tumor necrosis factor antibodies prompted a new era for patients with IBD, in which more effective medical management greatly decreased the need for surgery.⁸ Nowadays, patients have generally been exposed to several classes of biologics when a diagnosis of medically refractory UC is made and before surgery is required. Although the number of patients needing TPC has diminished overall,⁹ the patients who do need surgery tend to be sicker and older and have lower functional reserves than in past decades.¹⁰ As a consequence, staged IPAA's have increased during the past decade.

The decision to perform a staged versus nonstaged IPAA is not univocal but has to take into account the indication for TPC, the characteristics of the patient, the risk of anastomotic leak, the patient's overall capability to survive a symptomatic leak, and the surgeon's experience and level of confidence (Table 1).

TABLE 1. Appraisal of different staging approaches to IPAA

Stages	Stoma-less IPAA		IPAA with DLI	
	1-stage	Modified 2-stage	2-stage	3-stage
Description	TPC + IPAA	1) Total colectomy + ileostomy 2) Completion proctectomy + IPAA	1) TPC + IPAA + DLI 2) DLI reversal	1) Total colectomy + ileostomy 2) Completion proctectomy + IPAA + DLI 3) DLI reversal
Pros	Single operation No risk of ileostomy-related complications Best cosmetic result	Interval between colectomy and IPAA formation to improve nutritional status, optimize modifiable risk factors, achieve weight loss	No need for emergent reoperation in case of a leak Only 1 intra-abdominal operation (unless there is a need for laparotomy at DLI reversal)	Interval between colectomy and IPAA formation to improve nutritional status, optimize modifiable risk factors, achieve weight loss No need for emergent reoperation in case of a leak
Cons	Need for emergent reoperation in case of a leak	Two operations Need for emergent relaparotomy in case of a leak Ileostomy-related complications	Two operations Ileostomy-related and ileostomy closure-related complications	Three operations Ileostomy-related and ileostomy closure-related complications
Recommended for				
Patient population	Thin, healthy with good nutritional status	Malnourished, septic, or otherwise sick at first stage, obese	Thin, healthy with good nutritional status	Malnourished, septic, or otherwise ill at first stage, obese
Indication for colectomy	Elective or semielective	Urgent or emergent	Elective or semielective indication	Urgent or emergent
Risk of anastomotic leak at IPAA	Low	Low	High	High

DLI = diverting loop ileostomy; TPC = total proctocolectomy.

One-Stage IPAA

The pros of 1-stage IPAA are self-evident because it consists of only 1 operation with no stoma-related complications. Evidence regarding the outcomes of 1-stage IPAA is conflicting, with some authors reporting no differences in short-term and long-term outcomes,^{11,12} or even better outcomes,⁵ and others reporting worsened outcomes,^{13–15} mainly related to septic complications and postoperative ileus. Reports are largely based on retrospective analyses, which are inevitably susceptible to the inherent selection bias that patients with more favorable characteristics are more likely to be selected for a 1-stage procedure.

IPAA Versus No IPAA at First Stage

The patient's health status during the first stage is related to the indication for TPC. The most common indication for TPC in IBD is medically refractory disease, but TPC is also performed for urgent or semiurgent cases in the setting of acute severe colitis and its complications (toxic colitis, perforation) or elective cases, such as the development of colorectal dysplasia or cancer. Patients who require surgery for medically refractory colitis, and more so for acute severe colitis, usually have a compromised nutritional status and risk factors for poor wound healing and anastomotic leak. In such cases, performing only a total colectomy with ileostomy without IPAA during the first stage can give the patient enough time to recover, improve their nutritional status, and optimize any modifiable risk factors so that the pouch can be constructed in the best possible circumstances. An analysis of the National Surgical Quality Improvement Program (NSQIP) database showed that factors that increased the odds of receiving a 3-stage procedure were comorbidities (BMI, ASA score of 3 or more, diabetes mellitus, and ascites), steroid use, operative circumstances (emergency surgery, contaminated or dirty/infected wound class, and preoperative sepsis), nutritional status (preoperative albumin level and weight loss), and preoperative hematocrit level.¹⁶

This theoretical advantage of 3-stage procedures has been challenged by some retrospective analyses, in which short-term and long-term outcomes of conventional 2-stage IPAA in patients with active colitis were found to be similar to those of 3-stage IPAA.^{17–19} All reports identified more 3-stage operations performed in the emergency setting compared to 2-stage operations, suggesting that the same selection bias present in retrospective analyses of 1-stage versus staged IPAA cannot be excluded. Kochar et al²⁰ used the NSQIP database for a risk-adjusted analysis of IPAA (n = 1571) versus no IPAA (n = 819) at colectomy and found that patients with no IPAA at the first stage had a lower rate of reoperations (risk ratio, 0.42; 95% CI, 0.24–0.75), major morbidity (risk ratio, 0.72; 95% CI, 0.52–0.99), and minor morbidity (risk ratio, 0.48; 95% CI, 0.32–0.73).

Patients who undergo IPAA for oncological indications are generally healthier and may be viewed as more favorable candidates for a 1-stage procedure or a conventional 2-stage procedure. However, they may benefit from the pathological evaluation of the colectomy specimen before making a definitive decision on whether to proceed with IPAA.

The patient's BMI may also influence the decision on whether to perform IPAA during the first stage or not. The thicker mesentery present in patients with obesity can lead to reach problems of the ileal pouch to the anus, and the IPAA is often under tension. Patients with high BMI have an increased risk of anastomotic leak and pouch-related complications,^{2,21–24} making them poor candidates for undiverted IPAA. However, ileostomy creation in patients with obesity can be extremely challenging because of the body habitus and thickness of the abdominal wall, with a significant risk of pouching problems, retraction, and parastomal hernia formation.²⁵ If colectomy cannot be deferred, stage 1 with total colectomy and ileostomy is a possible compromise that gives time for the patient to engage in weight loss, or even bariatric surgery, between the first stage and IPAA formation.

Diversion Versus No Diversion at IPAA

The decision to construct a DLI at the time of IPAA formation requires a balance of the patient's risk of anastomotic leak, functional reserve to withstand a potential reoperation in case of undiverted anastomotic leak, and risk of ileostomy-related complications.

Age is a relevant factor when considering the need for a DLI. A recent meta-analysis of pediatric patients with IBD undergoing TPC with J-pouch found no differences in anastomotic leaks, small-bowel obstructions, pouchitis, or strictures with DLI versus no DLI at IPAA.²⁶ In contrast, a meta-analysis on modified 2-stage IPAA reported higher rates of anastomotic leak in the case of undiverted IPAA in pediatric patients compared to 3-stage procedures.²⁷ This was not observed in adult patients, who had lower anastomotic leak rates with modified 2-stage IPAA compared to conventional 2-stage IPAA. No conclusive evidence is available for older patients; however, a systematic review by Ramage et al²⁸ reported an increased risk of dehydration and electrolyte imbalance in the context of DLI in patients older than 65 years.

Indeed, although an ileostomy is often regarded as a safety-based choice, ileostomy-related complications should not be underestimated.²⁹ A recent study by Olecki et al³⁰ on 91 patients with stoma-less IPAA (1-stage or modified 2-stage) versus 323 patients with DLI at IPAA found that the only early-term and long-term difference between the 2 groups was a higher rate of postoperative anal fistulas in the stoma-less group. However, patients with a DLI had a 14.6% complication rate after ileostomy

reversal. A meta-analysis on complications of ileostomy closure after IPAA for UC or FAP reported 16.5% overall morbidity and a 3% reoperation rate.³¹ In addition to ileostomy-related complications, 2-stage and 3-stage procedures also have been associated with a higher rate of small-bowel obstruction compared to modified 2-stage procedures.³²

In contrast with the study by Olecki et al,³⁰ a recent retrospective study by Plietz et al³³ on 584 patients undergoing IPAA in a nonemergent setting reported an anastomotic leak rate in 10 of 314 patients (3.2%) after 3-stage IPAA, in 14 of 58 (8.6%) after conventional 2-stage IPAA, in 6 of 58 (10.3%) after modified 2-stage IPAA, and in 10 of 50 (20%) after 1-stage IPAA. It is likely that some selection bias and an effect from confounders were at play.

There is a need for prospective trials in this setting. A multicenter randomized trial on completion proctectomy and IPAA with DLI versus without DLI in patients with UC or indeterminate colitis (IDEAL trial, ClinicalTrials.gov: NCT03872271) is ongoing, and the results are eagerly awaited.

Appraisal

There is no definitive evidence on the optimal number of stages for IPAA. The choice of stages should be evaluated on a case-by-case basis, considering each individual patient, their characteristics (age, BMI, nutritional status, exposure to steroids, medications, comorbidities, expectations), their indication for surgery (urgent or emergent operation, medically refractory disease with severe systemic compromise, elective indication because of dysplasia or cancer), and their risk of anastomotic leak. Although safety toward a potential anastomotic leak should always be kept in mind, ileostomy-related complications should also be considered.

OPEN VERSUS MI-IPAA

IPAA has not been exempt from the increased utilization of MI surgery (MIS) in colorectal surgery. Laparoscopic IPAA were introduced in the early 90s, and robotic IPAA was first performed in 2010. The past 2 decades have seen

an increase in MI-IPAA, and MIS has become the standard of care for IPAA whenever feasible.

MIS offers several theoretical advantages compared to open surgery from potentially reduced surgical trauma (faster return of bowel function, faster early postoperative recovery, and shorter length of hospital stay), reduced tissue manipulation (less adhesion formation, less blood loss), and reduced incision length (reduced postoperative pain, reduced surgical site infections, better cosmetic result, and less incisional hernias).

However, the complexity of IPAA can make an MI approach challenging, especially in the deep pelvic space. MI-IPAA has a long learning curve, and some technical aspects, such as the positioning of the stapler in the pelvis and the correct alignment of the pouch mesentery, are more demanding in the MI setting.³⁴ The main advantages and disadvantages of the 2 approaches are summarized in Table 2.

Postoperative Outcomes

To the best of our knowledge, only 1 randomized controlled trial (RCT) on open versus laparoscopic IPAA has ever been completed. In 2004, Maartense et al³⁵ published their results on 60 patients randomly assigned to either hand-assisted laparoscopic (n = 30) or open (n = 30) IPAA. Operating time was longer for laparoscopy than open surgery. No differences were found in postoperative morbidity or early recovery after surgery. Costs were similar between the 2 approaches. Another RCT was attempted in 2013 but was interrupted because of insufficient recruitment.³⁶

In 2010, a systematic review on open versus laparoscopic IPAA for UC reported shorter fasting time and hospital stay after laparoscopic surgery and a lower overall complication rate (39.3% for laparoscopic versus 54.8% for open, $p = 0.004$).³⁷ Laparoscopy took, on average, 69 minutes longer than open surgery. Conversion to open surgery was required in 4% of cases. A Cochrane review on open versus laparoscopic IPAA for UC and FAP performed around the same time confirmed the longer operative time for laparoscopic IPAA (91 minutes on average) but failed to find any difference in

TABLE 2. Advantages and disadvantages of open versus minimally invasive IPAA

Approach	Open IPAA	Minimally invasive IPAA
Advantages	Faster Easier positioning of the stapler in the pelvis Easier visualization of the pouch mesentery	Better cosmesis Potential benefits in early morbidity and postoperative recovery Potential benefits in long-term functional outcomes Less adhesion formation
Disadvantages	Worse cosmesis May lead to more complications, slower recovery, and potentially worse long-term functional outcomes More adhesion formation	Slower Difficulty with stapler in the pelvis Potentially higher risk of pouch volvulus, long rectal cuff, and twisted pouch

morbidity, mortality, reoperations, and readmission rates.³⁸ Studies published after these meta-analyses were performed reported decreased overall morbidity after laparoscopic IPAA,^{39–41} including a risk-adjusted analysis of the NSQIP database on 337 laparoscopic versus 339 open IPAA.⁴²

Laparoscopic IPAA has been associated with better cosmetic results,⁴³ reduced blood loss,⁴⁴ reduced length of hospital stay,^{39,40,44} reduced time to postoperative bowel function,^{39,41,45,46} reduced postoperative pain,⁴¹ and reduced time to ileostomy closure compared to open surgery.⁴⁷ The rate of incisional hernias was reduced after laparoscopic IPAA as reported by Fichera et al,⁴⁶ but this was not confirmed by Benlice et al.⁴⁸

Functional Outcomes and Quality of Life

Functional outcomes appear to be similar after laparoscopic and open surgery. Fichera et al⁴⁶ assessed functional outcomes after open (n = 106) and laparoscopic (n = 73) IPAA and found no differences except for less daytime and nighttime pad usage in the laparoscopic group. Quality of life and satisfaction with surgery were also similar in the 2 groups, regardless of anastomotic technique (stapled versus handsewn). Baek et al⁴⁹ also reported similar functional outcomes, except for a lower frequency of daily bowel movements in the laparoscopic group and a trend toward higher continence rates (36.2% for laparoscopic vs 21.8% for open, $p = 0.06$). The laparoscopic group had a higher incidence of stapled anastomosis, but a subgroup analysis suggested that the difference between laparoscopic and open functional outcomes was not attributable to only the anastomotic technique. Lavryk et al,⁵⁰ in an analysis of 404 patients undergoing laparoscopic IPAA matched 1:1 with open IPAA, found similar long-term functional outcomes and quality of life between the 2 groups.

Adhesion Formation

Adhesion formation is a common consequence of open surgery, which is thought to be mitigated in MIS because of decreased tissue manipulation and trauma. Lower adhesion formation is relevant in this patient population because it may make ileostomy closure easier, reduce the risk of small-bowel obstruction, and improve fertility in female patients. Hull et al⁵¹ performed a diagnostic laparoscopy at the time of ileostomy closure in 40 patients after IPAA. They quantified adhesions using 2 scores, 1 for the abdominal wall and 1 for adnexal adhesions, of which the latter has been shown to correlate with fertility outcomes. They found significantly reduced incisional and total abdominal adhesion scores in the laparoscopic group. Similar findings were reported by Bartels et al⁵² on adhesions after total colectomy.

Although lower adhesion formation is generally regarded as a favorable outcome, this may have some

negative repercussions after IPAA. The lack of adhesions in the pelvis can increase the mobility of the pouch, increasing the risk of pouch volvulus,^{53,54} a rare but severe complication that can lead to pouch loss.

Fertility

As previously mentioned, pelvic adhesions are a possible source of infertility in female patients undergoing pouch surgery. By lowering adhesion formation, MI-IPAA may improve fertility outcomes.

Bartels et al⁵⁵ administered a questionnaire to 179 adult female patients who had IPAA before 41 years of age at 3 European centers. Of the 160 who responded, 50 had attempted a pregnancy: 70% (n = 19) of patients in the laparoscopic group versus 39% (n = 9) of patients in the open group became pregnant spontaneously (log-rank $p = 0.023$). This is consistent with the report by Beyer-Berjot et al⁵⁶ of an overall infertility rate after laparoscopic IPAA of 27%, a much lower rate than those reported in the literature for open surgery (43%–63%).^{57–59} Gorgun et al⁶⁰ performed a similar survey-based study on 890 female patients. Of their 519 (58%) responders, 161 had attempted conception after IPAA (18 laparoscopic, 143 open). The 2 groups had no differences in infertility rates (61% after laparoscopic, 65% versus open, $p = 0.69$), but the median time to pregnancy was shorter in the laparoscopic group than in the open group (3.5 vs 9 months, log-rank $p = 0.01$).

Technical Drawbacks of MI-IPAA

The perpendicular positioning of the stapler in the pelvis for rectal transection is certainly more arduous in the MIS setting than in open surgery. This may increase the chances of leaving a long rectal cuff, which can lead to persistent proctitis and cancer development in the retained rectum.

Similarly, the limited field of view in MIS can hinder the ability to visualize whether the ileal mesentery is correctly aligned, with an increased risk of twisted pouch syndrome.⁶¹

Laparoscopic Versus Robotic IPAA

A recent meta-analysis by Flynn et al⁶² reported comparable short-term and long-term outcomes between the robotic and laparoscopic approaches. The robotic platform may offer better visualization than laparoscopy for IPAA, and its increased range of movement may aid with pelvic dissection. Robotic IPAA has been shown to be a safe and feasible approach^{62–65}; however, its utilization is still low, with few reports in the literature.

Appraisal

The current evidence suggests that MI-IPAA might be superior to open IPAA, particularly in short-term outcomes and postoperative recovery, and should be the

preferred method whenever feasible. Most evidence comes from retrospective, noncontrolled analyses, and selection bias cannot be excluded. Pouch construction is a technically difficult operation, which is made even more challenging by the MI approach. Considering the complexity of this operation and of the patients who require it, open surgery still has a role.

The choice between laparoscopic and robotic IPAA currently seems to depend mostly on the surgeon's preference, platform availability, and type of practice, given the high costs of the robot and the lack of evidence on its superiority compared to laparoscopy. As with other procedures that require multiquadrant exposure, TPC can also be performed with a combination of laparoscopy and robotics,⁶⁶ maximizing the advantages of the 2 approaches. Particular attention should be paid to technical minutiae, such as the extent of pelvic dissection and correct mesentery alignment, when performing MI-IPAA.

TRANSABDOMINAL VERSUS TRANSANAL IPAA

The transanal approach was first developed for total mesorectal excision (TME) in rectal cancer (taTME),⁶⁷ particularly ultra-low rectal tumors. Theoretical advantages of the transanal approach compared to the transabdominal approach are the direct visualization of the distal resection margin, improved dissection in the narrow pelvic space, and decreased conversion to open surgery. Because rectal transection is performed transanally, this eliminates the previously mentioned issues with stapler positioning in the pelvis.

Over the past 8 years, the transanal approach has been adopted also in IPAA (ta-IPAA). As in taTME, the procedure can be performed by 1 team in 2 stages (transabdominal mobilization followed by transanal dissection) or by 2 teams working simultaneously and meeting at the peritoneal reflection. After the proctectomy is completed, the ileal pouch is brought down transabdominally and anastomosed to the anus with either a single-stapled or hand-sewn anastomosis. As described in the previous section, it is important to ensure that the mesentery is straight and that all the small bowels are on the left side of the abdomen when the anastomosis is performed.

Two recent meta-analyses showed similar short-term outcomes between the 2 approaches.^{68,69} Functional outcomes also appear to be comparable.^{70,71} Similar to robotics, the use of a transanal approach to IPAA is currently related to surgical confidence and technological availability. The history of taTME, which has failed to gain traction because of high rates of anastomotic leaks when performed in low-volume centers,⁷² should inspire caution for ta-IPAA as well. Truong et al,⁷³ regarding their initial single-center experience with ta-IPAA, reported a higher rate of anastomotic leaks with ta-IPAA compared to open (11% vs 2%, $p = 0.03$) and a steep learning curve. In

conclusion, ta-IPAA may have some advantages over the transabdominal approach in patients with a hostile pelvis, but its use should be limited to centers with relevant transanal MIS experience.

POUCH DESIGN

Pouches can be constructed with a J-, S-, W-, or K-design (Table 3). Compared to the others, the J-pouch does not mandate hand sewing, making it the easiest and fastest to construct and the most commonly used. The S-, W-, and K-pouch have higher reservoir volumes than the J-pouch, which may theoretically lead to better functional outcomes. However, W-pouches are bulky and may be difficult to position into the pelvis.

A recent meta-analysis reported higher rates of pouch failure for J- and S-pouches compared to W- and K-pouches,⁷⁴ but this was not confirmed when analyzing only RCTs, nor was it confirmed in studies published from 2000 onward.

Different pouch designs may need to be used because of intraoperative considerations. For example, in case of difficult reach of the pouch to the anus because of the short mesentery, an S-pouch is usually more feasible than a J-pouch.

In summary, the J-pouch represents the most commonly used pouch design, but other designs have good long-term outcomes, and they can be used according to the intraoperative situation, especially S-pouches in cases with difficult reach.

ILEAL POUCH-ANAL ANASTOMOSIS

The IPAA is usually either handsewn with mucosectomy or stapled with mucosal preservation (Table 4). In handsewn IPAA, the rectal mucosa is completely removed transanally, theoretically diminishing the risk of anal transition zone (ATZ) neoplasia for both IBD and FAP,^{75,76} as well as persistent proctitis in the case of UC. In stapled IPAA, the rectum is transected at the cephalad aspect of the anal sphincter ring, aiming at leaving a maximum rectal cuff of 1 to 2 cm. Compared to handsewn IPAA, the stapled IPAA has been associated with better functional outcomes.

A meta-analysis from 2006 showed better nocturnal continence with stapled IPAA,⁷⁷ but there was also a non-significant trend to a higher incidence of ATZ dysplasia. Better functional outcomes and quality of life were also reported by Kirat et al⁷⁸ in their study on 474 handsewn versus 2635 stapled IPAAs.

These potential functional benefits should be balanced with the oncological risks of ATZ neoplasia, especially in patients with cancer/dysplasia in their colectomy specimens. The incidence of cancer in the ATZ, rectal cuff, or pouch is around 0.5% for patients with IBD.⁷⁹ This low

TABLE 3. Advantages and disadvantages of different pouch designs

Pouch design	J-pouch	S-pouch	W-pouch	K-pouch
Advantages	Fastest and easiest to construct	Higher reservoir volume Possible better functional outcomes Better reach	Higher reservoir volume Possible better functional outcomes	Higher reservoir volume Possible better functional outcomes
Disadvantages	Difficult reach Lower reservoir volume	Handsewn Higher need for intubation Risk of efferent limb syndrome	Handsewn Higher need for intubation Bulky, difficult to set in the pelvis	Handsewn Rarely used

TABLE 4. Advantages and disadvantages of handsewn versus stapled IPAA

Type of anastomosis	Handsewn IPAA	Stapled IPAA
Advantages	Complete or near complete rectal mucosa removal	Better functional outcomes
Disadvantages	Worse functional outcomes, particularly nighttime leakage	Higher risk of ATZ neoplasia

ATZ = anal transition zone.

risk, combined with the evidence on functional outcomes, fully justifies the use of stapled IPAA in the majority of patients with IBD.

This procedure is more controversial in patients with FAP, whose risk of ATZ/pouch neoplasia is higher. The risk of pouch adenomas in FAP increases with time, from 7%–16% at 5 years to 75% at 15 years.⁸⁰ Consequently, some authors recommend a handsewn IPAA in these patients. However, a clear association between stapled IPAA and a higher risk of neoplasia development in FAP has not been established. In addition, ATZ mucosal resection during mucosectomy may be incomplete: in such a case, the pouch is brought down over an island of mucosa, covering it and preventing future endoscopic surveillance. Finally, most ATZ/pouch adenomas are small, endoscopically resectable, and have nonaggressive features. These considerations can also justify the use of a stapled IPAA without mucosectomy in patients with FAP.

IPAA IN CROHN'S COLITIS

Whether patients who develop colitis in the setting of known CD should be offered an ileal pouch is still a matter of debate. CD has generally been considered a contraindication to IPAA because it is thought to lead to poorer functional outcomes and higher pouch failure rates than other diagnoses.

Melton et al⁸¹ analyzed long-term outcomes of 204 patients with CD and IPAA and found a 71% overall 10-year pouch survival rate and good long-term outcomes (72% perfect/near-perfect continence, median of

7 bowel movements per day, median quality of life 9/10). Remarkably, they found better pouch survival in patients with known CD at IPAA (n = 20) and incidental CD diagnosis at IPAA (n = 97) compared to patients who were diagnosed with CD after IPAA (n = 87). These results were confirmed by a recent meta-analysis, including 6 studies on IPAA in known CD.⁸² The overall pouch failure rate was 15% (95% CI, 6%–35%), and functional outcomes were comparable to those reported for UC.

The better outcomes found in patients with known CD compared to post-IPAA CD are likely because of selection. However, these results suggest that IPAA may be offered to selected patients with known CD who are highly motivated and in whom any small bowel or perianal involvement has been thoroughly excluded.

CONCLUSION AND FUTURE PERSPECTIVES

An ileal pouch is considered a “1 shot” procedure, in which the first attempt is the best (and often the only) chance to obtain a good functional result and long-term maintenance of intestinal continuity. The success of an ileal pouch has many nuances, and several aspects should be considered on a case-by-case basis.

The current standard for pouch construction is a laparoscopic J-pouch with stapled anastomosis, but this is not a dogma. Although there is no need to reinvent the wheel for each case, and although having a standardized method is likely to yield better overall outcomes, each pouch must be tailored to the patient. Considerations of the patient's health status, disease history, and indication for surgery should drive the decision on the number of stages and surgical approach, but one should also take into account each surgeon's confidence and skill set. The J-pouch is the easiest and fastest to construct, but other designs may be needed whenever a J-pouch is not feasible or appropriate.

Most evidence on pouch surgery is based on retrospective reviews, often with conflicting results. This calls for a higher level of commitment to prospective research. However, it also highlights the multifactorial nature of pouch outcomes, which cannot easily be ascribed to a single aspect of the operation.

Pouch surgery will continue to evolve in line with surgical innovation, but each new shiny technology should not distract from the ultimate goal: a functioning pouch with low morbidity and good long-term outcomes.

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