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ORIGINAL ARTICLE

A Single-Center Comparative Study of Open Transabdominal and Laparoscopic Transanal Ileal Pouch-Anal Anastomosis with Total Mesorectal Excision. Has the Bar Been Raised?

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Abstract

Background Most ulcerative colitis (UC) patients requiring surgery undergo transabdominal ileal pouch-anal anastomosis (IPAA) performed minimally invasively or open. Although one multicenter study demonstrated acceptably low morbidity after transanal pouch, our initial single-center experience with transanal IPAA (ta-IPAA) was associated with an unacceptably high rate of anastomotic leak. The aim of this study was to compare the short-term outcomes of ta-IPAA and transabdominal IPAA with growing experience of transanal proctectomy and determine whether one approach offered any advantage or benefit over the other.

Methods Single-center series of consecutive ulcerative colitis patients underwent 3-stage IPAA, either ta-IPAA or transabdominal IPAA at a tertiary referral center. The primary outcome measure was overall complications until immediately prior to stoma closure. Secondary outcomes included postoperative clinical measures.

Results The study group consisted of 113 patients, which included 37 (33%) patients undergoing transabdominal or open IPAA and 76 (67%) patients undergoing ta-IPAA. The overall complication rate was numerically higher in the ta-IPAA group (56%) compared to the transabdominal group (38%) ($p=0.07$) as was the incidence of anastomotic leak in the ta-IPAA group (12 vs. 5%) ($p=0.17$). Mean length of hospital stay was significantly higher in the transanal IPAA group ($p=0.04$). Operating time, opioid use and pain scores were similar between groups.

Conclusion Transanal IPAA has a higher incidence of overall complications and anastomotic leak compared to transabdominal IPAA. Postoperative length of stay is significantly higher in patients undergoing ta-IPAA. Operating room time, opiate use and pain scores are comparable between the two surgical approaches. Transanal IPAA appears to offer little advantage over transabdominal IPAA.

Keywords IBD · IPAA · Transanal · Leak · Complication · Case series

Introduction

The preferred procedure for ulcerative colitis (UC) patients requiring surgery for medically refractory disease or neoplasia is a transabdominal ileal pouch-anal anastomosis (IPAA) performed either in a minimally invasive fashion or open.[1–3] Minimally invasive IPAA has proven short-term and long-term benefits over the open approach, including reduced pain, shorter hospital stays, improved cosmesis and higher rates of female fecundity.[4–8] However, the procedure is still associated with significant postoperative morbidity related to anastomotic leaks, abscesses and resultant pelvic sepsis which can have considerable implications on pouch function and success.[2,9,10] The challenges of a deep pelvic dissection can be difficult to overcome as even laparoscopy has

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technical limitations when it comes to the bony constraints of the pelvis.[9,11] Inadequate visualization and restricted freedom of movement due to an oblique pelvic angle may result in imprecise dissections leading to inadvertent injury to autonomic nerves, and multiple staple firings sometimes needed to transect the rectum may increase the rates of anastomotic leak.[12,13]

To mitigate the technical difficulties posed by a transabdominal approach, a transanal IPAA (ta-IPAA) was adopted and for several years has been gaining popularity with its advantage of improved access and visualization in the pelvis to allow for a more precise rectal transection and control over the level of the anastomosis.[9,14,15] Initial reported results of the ta-IPAA have demonstrated its safety and feasibility,[11,16] and the few comparative studies to date have suggested similar if not improved postoperative morbidity and functional outcomes.[14,15] Despite these promising findings, our institution's early experience with 65 ta-IPAA patients was associated with an unacceptably high rate of anastomotic leaks with the ta-IPAA approach.[17] The aim of this study was to compare short-term surgical outcomes of ta-IPAA and transabdominal IPAA performed within a concurrent study period and evolving experience with the transanal approach.

Materials and Methods

Study Design

Prospectively accrued data of patients undergoing a three-stage IPAA for medically refractory UC or dysplasia/neoplasia at a single center between November 2016 and September 2020 were retrospectively evaluated. Patients undergoing a transabdominal IPAA, including multiport laparoscopic, open or a hybridized approach were compared to patients who underwent a ta-IPAA. The choice of surgical approach was at the discretion of the operating surgeon. All operations were performed by two experienced colorectal surgeons using a J-pouch with protective diverting ileostomy. Patients with IBD-unclassified, Crohn's disease or undergoing emergency surgery were excluded. This study was approved by the Cedars-Sinai Medical Center Institutional Review Board (IRB #Pro0003393).

Clinical Characteristics

Patient's clinical profiles including demographics and disease characteristics were prospectively tabulated. Demographic information included patient age at time of surgery, sex and body mass index (BMI). Disease characteristics included type of preoperative medication use, indication for surgical intervention and preoperative laboratory values. The diagnosis of UC was based upon standard clinical, endoscopic, radiologic and pathological criteria.[18] Medical therapy in the month before surgery included steroids (intravenous or oral), immunomodulators (6-mercaptopurine, azathioprine, methotrexate, or cyclosporine) or biologics (both large and small molecule). Indications for surgery were categorized as medically refractory or dysplasia/cancer. Laboratory values (hemoglobin and serum albumin) within one week of surgery were also collated.

Surgical Techniques

As previously described,[19] ta-IPAA was started using a single port access system (GelPOINT® Mini Advanced Access Platform, Applied Medical Inc., Rancho Santa Margarita, CA, USA) at the site of the ileostomy after mobilization and stapled closure of the stoma. An additional 5 mm suprapubic port was used to facilitate the dissection. Mesenteric attachments of the small bowel were mobilized off the duodenal sweep to the pancreatic head and origin of the mesenteric vessels to ensure adequate reach of the ileal pouch. A 15–20 cm pouch was constructed through the ileostomy site, and the apex of the pouch was closed with a pursestring suture before being placed back into the abdomen in order to proceed to the transabdominal rectal dissection. The rectum was mobilized after division of the superior rectal artery and dissection carried down to the peritoneal reflection while the second surgeon began the transanal dissection if employing a two-team approach. A Pfannenstiel incision was created in few selected cases in order to facilitate the rectal dissection transabdominally. A Lone Star® retractor (CooperSurgical, Inc., Trumbull, CT, USA) was used to evert the anus and a GelPOINT® path access channel inserted. Once pneumorectum to 12 mmHg was achieved, a purse string suture was placed and a proctotomy created 1 cm distal to the pursestring using a Endopath® Probe Plus hook (Ethicon Inc., Somerville, NJ, USA). Once the rectum was dismounted and removed transanally, the ileal pouch was either exteriorized to prepare for a double-purse string (single-stapled) anastomosis or brought down to the pelvis for a handsewn anastomosis after mucosectomy. A reverse air leak test was performed in all patients, and any leak identified intraoperatively was repaired transanally.

A transabdominal IPAA was performed either open or with a hybrid approach utilizing laparoscopy with a single port access system through the site of the mobilized ileostomy. An abdominal incision, either Pfannenstiel or midline, was created to facilitate the rectal dissection or transection. A linear stapler is used to transect the rectal stump after complete mobilization of the rectum. An ileal pouch was constructed either through the ileostomy site or the Pfannenstiel/ midline incision. An apical pursestring suture was then secured around the rod of the anvil for the circular stapler

and oriented in the pelvis. The stapler was introduced into the anus and mated with the anvil to create a double-stapled anastomosis. Alternatively, a handsewn anastomosis to the dentate line was created after performing a transanal mucosectomy in those patients with a diagnosis of dysplasia, if a stapled anastomosis was precluded by severe mucosal disease extending to the dentate line or as a salvage technique if the staple lines had disrupted. Even in patients with a benign indication for surgery, a total mesorectal excision (TME) was undertaken in both groups. An air leak test and intraoperative pouchoscopy was performed in all patients. In all ta-IPAA and transabdominal IPAA patients where pouch-reach was limited or when considerations of pouch function superseded concerns over retained mucosa, a handsewn anastomosis to the rectal cuff rather than the dentate was performed.

An enhanced recovery pathway after surgery was initiated for all patients preoperatively, intraoperatively and postoperatively. This included use of a standardized preoperative bowel mechanical bowel regime, prioritizing non-opioid analgesics and using a multimodal pain regimen including avoidance of patient opioid-controlled analgesia. Intravenous fluids were limited intraoperatively and postoperatively and were titrated for urine output. Clear liquids were started on postop day 0 for all patients and was advanced as tolerated without waiting for bowel function. Ileostomy closure was usually performed two months after IPAA creation after obtaining routine contrast pouchogram and performing pouchoscopy 4 weeks post-operatively.

Surgical Outcomes

The primary outcome measure was the incidence of total complications that developed from the time of surgery until time of diverting ileostomy closure. These outcomes were stratified into the time of their recognition (early versus late) and whether they were specifically related to the ileal pouch (pouch-specific versus non-pouch specific). Early complications were defined as those occurring within 30 days of IPAA while late complications occurring 30 days after surgery until time of stoma closure. Pouch-specific complications included pelvic abscess, leak or stricture. Anastomotic leaks were defined as any disruption of the staple line that was evident radiographically via pouchogram or diagnosed intraoperatively during a leak test or with endoscopy. Subclinical leaks (asymptomatic patients diagnosed on routine postoperative pouchogram) were still considered anastomotic leaks. These were distinguished from other "pouch-related complications" (i.e., abscess, stricture) which did not have any evidence on exam, pouchogram or pouchoscopy of a disruption in the anastomotic line. Overall complications were assessed via the Clavien–Dindo Classification (CDC)[20] with the highest grade being assigned if multiple complications requiring therapies were present.

Secondary outcomes included operative time, opioid use (morphine equivalent daily dose), postoperative day 1 and 2 pain scores using a visual analogue scale, length of hospital stay and 30-day hospital readmission. Postoperative pain scores were reported as average scores over 24-h periods. Postoperative quality measures such as length of stay and 30-day readmission were also recorded.

Statistical Analysis

Descriptive statistics was performed using an online statistics calculator (http:// www.graphpad.com) with continuous variables reported as mean (SD) and categorical variables as n (%). Continuous variables were compared using the Wilcoxon rank-sum test and categorical variables compared using Fisher's exact test. A p-value of <0.05 was considered statistically significant.

Results

Clinical Features

Of the 113 study patients, 76 (67%) underwent a ta-IPAA and the remaining 37 (33%) had a transabdominal IPAA (Table 1). Age and BMI were similar between groups. Although ta-IPAA was performed more commonly in females, this trend did not reach statistical significance. Patients with rheumatoid arthritis (n = 7) and ankylosing spondylitis (n = 6) were being treated with biologics at the time of surgery. Significant differences were noted between groups in anastomotic configuration. As expected, all double-stapled anastomoses were performed in the transabdominal IPAA group while all single-stapled anastomoses were created in the ta-IPAA group. Of the 63 handsewn anastomoses, 45 (71%) were sutured to the dentate line and 18 (29%) sewn to the rectal cuff. Of the seven handsewn anastomoses performed in the transabdominal group, four (57%) were at the level of the dentate while the remaining three (43%) were sewn to a rectal cuff. There were 56 handsewn anastomoses performed in the ta-IPAA group with 41 (73%) sewn to the dentate and 15 (27%) to a rectal cuff. There was a significantly higher incidence of anastomoses to the dentate line versus the rectal cuff in patients undergoing ta-IPAA.

Surgical Outcomes

Mean operative time was about 5 h and did not differ significantly between patient groups (Table 2). Interestingly, mean pain scores and opioid use were also similar between patient groups. Mean length of hospital stay was almost one day

Table 1 Clinical features

Surgical Approach	Transabdominal (n = 37)	Transanal pouch (n = 76)	*p*-value
Age (yr)	36.3 ± 18.4	36.5 ± 16.6	0.95
Sex			0.048
Male	24 (65)	34 (45)	
Female	13 (35)	42 (55)	
BMI (kg/m^2)	22.5 (3.6)	22.4 (3.6)	> 0.99
Indication for surgery			0.71
Medically refractory disease	35 (95)	69 (91)	
Dysplasia/neoplasia	2 (5)	7 (9)	
Biologic Use	6 (16)	7 (9)	0.35
Preoperative hemoglobin (g/dl)	13.4 ± 1.6	12.9 ± 1.7	0.14
Preoperative albumin (g/dl)	4.4 ± 0.3	4.4 ± 1.3	> 0.99
Type of pouch-anal anastomosis			< 0.01
Single stapled	0	20 (26)	
Double stapled	30 (81)	0	
Handsewn	7 (19)	56 (74)	
Pouch-anal anastomotic level			< 0.001
Cuff	33 (89)	35 (46)	
Dentate line	4 (11)	41 (54)	
Approach to rectal dissection			< 0.01
Laparotomy	14 (38)	0	
Pfannenstiel	23 (62)	7 (9)	
Laparoscopic	0	69 (91)	

All values expressed as mean ± SD or n (%)

BMI body mass index

longer in the ta-IPAA patients (4 days) versus the transabdominal IPAA patients (3 days) (p = 0.04). The 30-day readmission rate however was similar between groups (overall 26%).

Postoperative complications were seen in 57 (50%) patients (Table 2). There was an increased rate of both overall and pouch-specific complications in the ta-IPAA group but this difference was not statistically significant. Most complications (n = 46) occurred early within the first 30 days following surgery and included small bowel obstruction/ileus (n = 16), anastomotic leak (n = 8), urinary tract infection (n = 6), dehydration requiring admission for hydration (n = 4), urinary retention (n = 3) and symptomatic acute blood loss requiring transfusion (n = 2). Other additional complications included abdominal wall abscess, intraabdominal hematoma, central line infection, fascial dehiscence treated without surgery and upper GI bleeding (all n = 1). One patient presented with abdominal pain and fevers and was diagnosed with a presacral abscess for which he was successfully treated with antibiotics. Another patient was taken for an examination under anesthesia and pouchoscopy due to severe pelvic pain and was found to have no leak or abscess. Late complications included small bowel obstruction/ileus (n = 4), anastomotic leak (n = 3), pelvic abscess without leak (n = 2), anastomotic stenosis requiring Hegar dilation (n = 1) and ischiorectal abscess without demonstrable leak (n = 1).

Anastomotic leaks were identified in 11 (10%) patients, eight of which occurred within 30 days of surgery (Table 2). Even though the leak rate was almost threefold higher in the ta-IPAA group (12%) compared to the transabdominal IPAA group (5%), this trend did not reach statistical significance. In the ta-IPAA group, eight (89%) of the nine leaks occurred with a handsewn anastomosis (6 [75%] sewn to the dentate line and 2 [25%] sewn to a rectal cuff) and 1 (11%) leak occurred after a single stapled anastomosis to a rectal cuff. In the transabdominal group, of the two total leaks that developed, one occurred a handsewn anastomosis to the dentate and the other leak after a double stapled anastomosis to a rectal cuff.

Most leaks (8 of 11) required some form of intervention in addition to antibiotic therapy. The two leaks in the transabdominal group both required percutaneous drainage procedures. One patient went on to develop a fistula between the pouch and afferent limb requiring stent. Both ultimately did well after ostomy closure and had no fluoroscopic evidence of a leak on subsequent pouchogram. Of the nine leaks in the transanal group, two patients

Table 2 Surgical outcomes

Surgical approach	Transabdominal (n = 37)	Transanal (n = 76)	*p*-value
Operating time (min)	313.6 ± 58.1	319.8 ± 55.4	0.58
Total opioid use (MEDD)	78.9 ± 66.6	114.4 ± 157.6	0.19
Pain score (1–10)			
POD 1	4.7 ± 1.7	4.8 ± 1.4	0.74
POD 2	4.7 ± 1.6	4.4 ± 1.5	0.33
Total complication*	14 (38)	43 (57)	0.07
Early complication	13 (35)	36 (47)	0.23
Late complication	1 (3)	9 (12)	0.16
Pouch-specific complication*	2 (5)	12 (16)	0.14
Anastomotic leak	2 (5)	9 (12)	0.17
Stricture	0	1 (1)	> 0.99
Abscess	0	2 (3)	> 0.99
Non-pouch-related complication*	11 (30)	33 (43)	0.22
Grade of complication (Clavien-Dindo)			
No complication	23 (62)	33 (43)	0.07
Grade 1	3 (8)	10 (13)	0.54
Grade 2	6 (16)	19 (25)	0.34
Grade 3	5 (14)	12 (16)	0.59
Grade 4a	0	2 (3)	> 0.99
Grade 4b	0	0	-
Grade 5	0	0	-
LOS (d)	3.30 ± 1.15	4.09 ± 2.26	0.04
30-day readmission	10 (27)	20 (26)	> 0.99

All values expressed as mean ± SD or n (%)

MEDD morphine equivalent daily dose; POD postoperative day; LOS length of hospital stay

**Some patients experienced both early and late complications as well as both pouch and non-pouch complications*

underwent an examination under anesthesia (EUA) with transanal repair and one patient underwent percutaneous drainage with resolution of the leak on subsequent imaging. Two patients were successfully treated with antibiotics alone. One patient developed pelvic sepsis and was treated successfully with antibiotics only as percutaneous drainage was not technically feasible. One underwent percutaneous drainage and an exam under anesthesia (EUA) demonstrating a large posterior anastomotic dehiscence which could not be repaired. This patient went on to develop a chronic presacral abscess with a fistula to the vagina and uterus. Pouch excision was discussed, but she was ultimately lost to follow-up. One patient underwent percutaneous drainage and subsequent EUA with transanal repair of posterior midline dehiscence. This patient ultimately underwent pouch revision. One patient developed pelvic sepsis which was managed by another hospital with no records available and was lost to follow-up.

Complication severity between groups is shown in Table 2. Although the ta-IPAA patient group (44%) had a higher rate of complications classified as Clavien–Dindo grade 2 or higher than the transabdominal patient group (30%), this difference was not statistically significant.

All but one patient underwent reversal of their diverting loop ileostomies. Six conversions to an open transabdominal procedure occurred in the ta-IPAA group (6.5%) with one conversion performed to assess length.

Discussion

Ileal pouch surgery at our tertiary IBD referral center has evolved over time from long midline incisions to minimally invasive surgery with improvements in both short-term and long-term outcomes. Based on the potential advantages of a transanal approach to rectal cancer,[21,22] we started using the ta-IPAA approach in IBD patients. Although others have reported that the procedure is safe,[23] our initial experience comparing ta-IPAA to a historic cohort who underwent open IPAA was marred with an unacceptable rate of pouch-anal anastomotic leaks after the transanal approach.[17] Studies using a historical comparator group often have chronology

bias, a bias that occurs because of changes in the way treatments are delivered, diseases are detected, or even in the methods used to measure variables or outcomes.[24] Although the current study compared short-term surgical outcomes of ta-IPAA and transabdominal IPAA performed within a concurrent study period and with increased experience with the transanal approach, there was an almost threefold increase in anastomotic leaks in ta-IPAA. In addition, length of hospital stay was significantly higher in the transanal IPAA group ($p = 0.04$), most likely due to the higher incidence of postoperative complications seen in the transanal group. Despite the lack of an abdominal incision with the ta-IPAA approach, there was no significant improvement in operating time, opioid use or pain scores compared to the transabdominal approach. Taken together, our results suggest that routine use of ta-IPAA in UC requires critical reassessment.

We noted a significant difference in sex distribution between the ta-IPAA and transabdominal IPAA cohorts, with more females undergoing ta-IPAA. Assessment of adequate pouch length to the anus inherently factors into the decision of whether a double-stapled anastomosis or a mucosectomy can be performed. Pouch length assessment in transabdominal IPAA is performed through an abdominal incision using the inferior border of the pubic symphysis as a marker or even a trial of pouch descent to the anus.[25] Both maneuvers are difficult in ta-IPAA, where length assessment can be misleading due to both abdominal wall thickness and angulation at the open stoma site. Since males tend to be taller with more variability in pelvic anatomic features such as sacrococcygeal length and curvature,[26] any question of a tension-free anastomosis likely precluded males from undergoing ta-IPAA. Even with our conservative selection of patients for ta-IPAA and the employment of lengthening maneuvers when needed such as division of the ileocolic artery or select distal vessels, this group still experienced an unacceptable high incidence of pouch-related complications and anastomotic leaks.

Despite its growing popularity, few comparative studies to date have compared the outcomes of transabdominal IPAA to ta-IPAA. The first comparative study by de Buck van Overstraeten et al. which assessed short-term outcomes in 97 patients undergoing ta-IPAA demonstrated lower postoperative morbidity with this approach compared to transabdominal IPAA. Interestingly, their results also showed the ta-IPAA group had a numerically higher incidence of anastomotic leak compared to the transabdominal group.[14] A second comparative study, detailing outcomes of ta-IPAA vs transabdominal IPAA, was recently published by Chadrasinghe et al.[15]. They demonstrated a higher rate of severe (Clavien–Dindo 4) complications after transabdominal IPAA compared to ta-IPAA [$p = 0.07$]. Additionally, they demonstrated a lower anastomotic leak rate after ta-IPAA though the difference was also not statistically significant [$p = 0.09$]. Reasons accounting for the difference in our outcomes are unclear; however, the variability in type and level of anastomosis as well as the plane of rectal dissection may play a role.

Of the nine patients with anastomotic leaks after taIPAA, eight patients had a handsewn anastomosis while of the two patients that leaked after transabdominal IPAA, one had undergone a handsewn anastomosis and the other a double-stapled anastomosis. Our results suggest that a handsewn anastomosis may be implicated in higher leak rates, but a more in-depth analysis of the type and level of anastomosis is needed to fully assess any causal relationship between surgical outcomes and anastomotic technique in transanal pouch surgery. Although one controlled trial by Bartels et al.[27] demonstrated lower rates of anastomotic leaks in IPAA patients who underwent close rectal dissection (CRD) compared to using the TME plane, all our patients underwent a TME and thus, in our experience, the more than doubled rate of anastomotic leaks seen in the ta-IPAA group versus the transabdominal group cannot be attributed entirely to the rectal dissection technique.

Interestingly, in our ta-IPAA cohort, the number of pouch-related complications (including leaks) was identical in the early (less than 30), mid- (30–50 cases) and later (50 + cases) periods of the learning curve with four pouch-related complications (3 leaks) occurring in each tertile. If we divide the cohort into two groups, there were five pouch-related complications, three of these leaks, in the first half (patients 1–36) and seven pouch-related complications with six leaks in the later half. Extrapolating from studies of transanal TME for rectal cancer, learned proficiency of ta-IPAA may only occur after 30–50 cases[28]; however, our results suggest that more experience with this procedure in addition to standardization of anastomotic techniques and mesorectal dissection may be needed for improved outcomes.

Despite its single-center design and homogeneity of surgical judgement, a major limitation of this study is the small sample size which may have led to a type I error and in the absence of statistical significance, definitive conclusions are understandably difficult to glean from these results. In addition to the lack of a standard anastomotic technique which may have further confounded surgical outcomes respective to a TME dissection, certain patient factors (e.g., diabetes mellitus, co-morbidities, tobacco use) and other pertinent operative factors (e.g., blood loss, incomplete stapler donuts) were not recorded. This study is one of the few comparative studies to date with a relatively large cohort of patients undergoing ta-IPAA; however, we acknowledge that further studies controlling for confounding mediators with a larger sample population are certainly needed to determine the superiority of one approach over the other.

Conclusions

In our experience, ta-IPAA with TME had a non-statistically significant higher incidence of overall and pouch-related complications and significantly longer length of hospital stay compared to transabdominal IPAA. Operating room time, opiate use and pain scores were comparable between the two surgical approaches. Transanal-IPAA appears to offer little advantage over transabdominal IPAA and has been largely abandoned by surgeons at our center.

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