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REVIEW

Ileal-anal pouches: A review of its history, indications, and complications

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Abstract

The ileal pouch anal anastomosis (IPAA) has revolutionised the surgical management of ulcerative colitis (UC) and familial adenomatous polyposis (FAP). Despite refinement in surgical technique(s) and patient selection, IPAA can be associated with significant morbidity. As the IPAA celebrated its 40th anniversary in 2018, this review provides a timely outline of its history, indications, and complications. IPAA has undergone significant modification since 1978. For both UC and FAP, IPAA surgery aims to definitively cure disease and prevent malignant degeneration, while providing adequate continence and avoiding a permanent stoma. The majority of patients experience long-term success, but "early" and "late" complications are recognised. Pelvic sepsis is a common early complication with far-reaching consequences of long-term pouch dysfunction, but prompt intervention (either radiological or surgical) reduces the risk of pouch failure. Even in the absence of sepsis, pouch dysfunction is a long-term complication that may have a myriad of causes. Pouchitis is a common cause that remains incompletely understood and difficult to manage at times. 10% of patients succumb to the diagnosis of pouch failure, which is traditionally associated with the need for pouch excision. This review provides a timely outline of the history, indications, and complications associated with IPAA. Patient selection remains key, and contraindications exist for this surgery. A structured management plan is vital to the successful management of complications following pouch surgery.

Key words: Ileal pouch; Restorative proctocolectomy; Ulcerative colitis; Crohn's disease; Familial adenomatous polyposis

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Core tip: The ileal pouch remains a mainstay for the surgical management of ulcerative colitis and familial adenomatous polyposis. From its inception in 1978, there have been developments in the technical approaches to this surgery, with recent advancements including robotic surgery, transanal proctectomy, and single incision laparoscopic surgery. Despite these advancements, pouch surgery remains confounded with complications which must be recognised by gastroenterologist and surgeon alike. This review looks to provide a contemporary outline of the history, indications, and complications of ileal pouch surgery.

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INTRODUCTION

As the ileal-anal pouch procedure celebrated its 40th anniversary in 2018, a review of the history of the pelvic ileal reservoir procedure, and its indications and complications, is timely and relevant.

HISTORY OF THE ILEAL POUCH

The first reported case of the anastomosis of ileum to the anal sphincter complex was presented by Rudolph Nissen to the Berlin Surgical Society in April 1933[1]. This case appears to have involved the construction of a double-barrelled loop of ileum that was anastomosed to the anal sphincter complex by means of a combined abdominal and sacral approach. The end result was not successful.

Between 1941 and 1946, R Russell Best in Omaha, NE, United States, carried out nine procedures that he labelled as ileoproctostomies, stating explicitly that the anastomosis was between the ileum and the anus, thus differentiating this from an ileorectostomy in which ileum would be anastomosed to the rectum. Best stated that "any anastomosis 2.5 cm or more above the mucocutaneous line should be classified as an ileoproctostomy"[2]. His first report of the procedure was not optimistic because of the accompanying complications, but Best felt that improvements in technique would alter the evaluation of the procedure.

In 1947, Ravitch and Sabiston[3], following a series of experiments on animals, suggested anastomosis of ileum to the anus by a modified pull-through technique with the entire colon and terminal ileum exteriorised through the anus, after which the ileum was sutured to the anal sphincter mechanism. By 1951, Ravitch had carried out this procedure in 13 patients. In Philadelphia, PA (1952), Valiente and Bacon returned to Nissen's premise of the use of loops of ileum as a functional reservoir and constructed a three-loop pouch with an efferent spout that was sutured to the anal sphincter. He performed this experimental series in seven dogs[4]. The authors concluded that, although sadly five of the dogs died, the result from two of the dogs were satisfactory - preservation of anal sphincter control in its entirety and a gradual change in the consistency of stool from mushy to formed. They observed that perianal irritation was minimal.

Interestingly, subsequent to this, the concept of the ileal reservoir was moved out of the pelvis and onto the abdominal wall by the work of Nils Kock in Gothenberg, Sweden (Figure 1A). The seminal paper was produced in 1969[5] and by the 1970s many patients were being offered a continent ileostomy. When it worked well, the continent ileostomy significantly improved the quality of life of the patient, but was frequently associated with complications, particularly slippage of the nipple valve; in this instance the patient would often require multiple revision procedures.

The great evolution in pouch surgery was heralded in 1978 when Sir Alan Parks and Mr John Nicholls effectively combined the idea of a three-limbed ileal reservoir with ileo–anal anastomosis. With this advance, Parks and Nicholls are credited as the first to describe the ileal pouch anal anastomosis (IPAA), having fashioned the S-

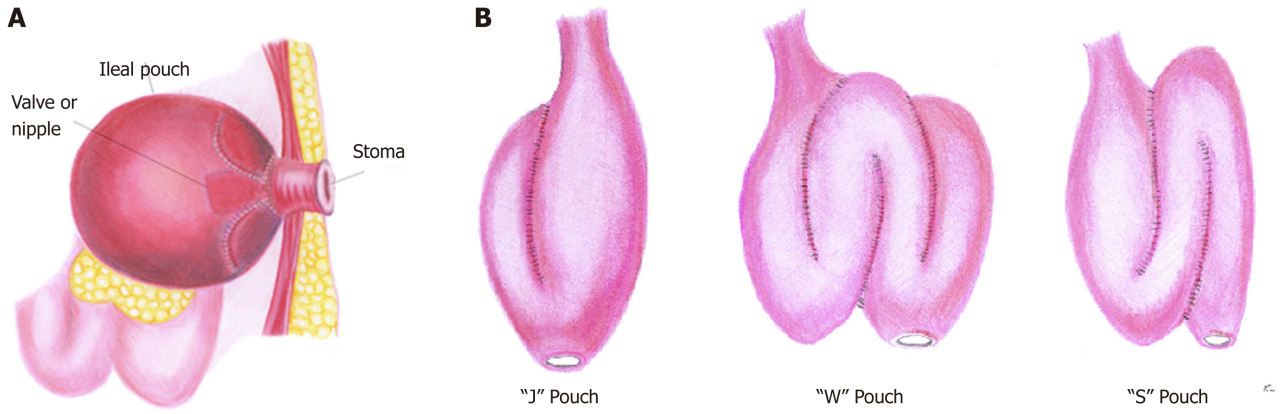

Figure 1 History of the ileal pouch. A: The Kock continent ileostomy; B: Common pouch configurations used in ileal pouches.

shaped pouch for patients with ulcerative colitis (UC) after proctocolectomy. Their original description included a mucosectomy followed by a hand-sewn anastomosis between pouch and anus[6].

Since then, much has progressed in the surgical approach to pouch formation. For example, most surgeons nowadays favour a J-shaped pouch (Figure 1B), first described in 1980 by Utsunomiya *et al*[7]. This preference for a J-pouch is supported by a meta-analysis which demonstrated its superior function over S- or W-pouch configurations[8]. The J-pouch also confers an excellent long-term quality of life, and is easier to construct[9]. There has also been progression in the way the anastomosis is fashioned, with most contemporary surgeons favouring a stapled rather than hand-sewn anastomosis. While hand-sewn anastomoses permit mucosectomy (*i.e.*, removal of a potentially diseased rectal cuff), any benefit from this seems offset by risk of damage to the anal sphincter and anal transition zone (ATZ), which is an important sensory rich area of the anal canal that allows flatus/stool discrimination[10]. A stapled IPAA, on the other hand, avoids a mucosectomy and is quicker to perform[11]. Moreover, it would appear that a stapled IPAA offers patients a better functional outcome with lower incidence of incontinence and nocturnal seepage[12], justifying the preference of surgeons towards a stapled IPAA.

Finally, the past decade has seen great advancement in the use of innovative surgical technology for pouch surgery. While laparoscopic approaches for IPAA have been described since the 1990s and have been demonstrated to be feasible and safe[13], surgical techniques have progressed rapidly to robot-assisted techniques[14,15], single incision laparoscopic surgery (SILS)[16], transanal proctectomy (TaTME)[17], and natural orifice specimen extraction[18]. These new techniques promise to improve surgical accuracy, postoperative recovery, and postoperative pain, and while studies exist to demonstrate their feasibility[19], robust data regarding their efficacy in pouch surgery is awaited[20].

Despite such modifications in surgical technique over the past 40 years, IPAA remains a high-risk operation, with a recent push towards centralisation of this operation to high volume centres[21,22]. IPAA is accompanied by complications that challenge the surgeon and gastroenterologist alike, and have far-reaching consequences for the patient. The subsequent sections of this review look to provide an up-to-date appraisal of indications (and contraindications) to IPAA surgery, and outline common postoperative complications and their management.

INDICATIONS

Restorative proctocolectomy (RPC) with an IPAA is the procedure of choice for a variety of pathologies, including: UC; classic familial adenomatous polyposis (FAP); and other polyposis syndromes or conditions with multiple synchronous cancers involving the rectum. In one meta-analysis of over 9000 patients undergoing IPAA, the indications for surgery were: UC (87.5%); indeterminate colitis (IC) (2%); Crohn's disease (0.8%); FAP (8.9%); and other diagnoses (0.7%)[23]. For all indications, though, the aim of RPC/IPAA remains the same: To definitively cure disease and prevent malignant degeneration, while providing adequate continence and avoiding a permanent stoma[24].

Ulcerative colitis

UC is a chronic inflammatory disease of the colon and rectum. Surgery for UC is indicated in five instances: (1) Acute colitis unresponsive to medical therapy; (2) Disease which is later refractory to medical treatment; (3) Patients who fail to tolerate medical treatment or its adverse effects, including steroid-dependent disease; (4) Cases of neoplastic or dysplastic transformation of the intestinal mucosa; and (5) In the paediatric setting where there is failure to thrive.

Previous studies have estimated that approximately one-third of patients with UC will succumb at some point to surgery[25,26]. However, contemporary studies demonstrate that colectomy rates for UC are decreasing, probably due to improvements in medical rescue therapies[27,28]. In fact, a recent population-based cohort study observed 5-, 10-, 15-, and 20-year cumulative colectomy rates after diagnosis of 4.1%, 6.4%, 10.4%, and 14.4%, respectively[29]. There are a number of surgical options available to UC patients. Conventional proctocolectomy involves removal of the colon and rectum and immediate formation of a permanent end ileostomy[30]. While early studies suggested that patients adapt to their ileostomy[31,32], other studies have described psycho-social problems as a result of stoma formation[33,34]. Cli-nicians have therefore sought procedures that avoid the need for a permanent ileostomy. Herein lies an important point, that in a sense, the sole indication for a RPC (*i.e.*, with IPAA) is the desire to avoid a permanent ileostomy. Nevertheless, such has been the success with IPAA surgery that by as early as 1989, the procedure was considered the first choice elective operation for patients with UC[35].

There has been much debate in the timing of pouch surgery for UC patients. Most surgeons would agree that the timing is largely driven by the physiological/metabolic status of the patient and their existing immunosuppression[36]. Indeed, the majority of patients undergoing surgery for UC are on chronically high doses of immunomodulating agents (including steroids, azathioprine, biological therapy), which affect postoperative outcomes[37]. One study found that patients who received preoperative steroids were at higher risk of pouch-related sepsis[38], and moreover, patients taking higher steroid doses (> 40 mg) were at greater risk compared to those taking lower doses or no steroid at all. The conclusion of that study was to defer IPAA in favour of a non-restorative proctocolectomy or subtotal colectomy in patients receiving > 20 mg of steroid at the time of surgery, a finding which is in agreement with current European guidelines on pouch construction for UC patients[39].

Regarding anti-TNFα and anti-integrin agents, current Association of Coloproctology Great Britain and Ireland (ACPGBI) guidelines suggest that where clinical circumstances permit, these should be withheld for 14 to 30 d prior to elective surgery for UC[36]. Evidence on this topic, however, is poor. One meta-analysis demonstrated that pre-operative infliximab use increased the risk of short-term post-operative complications in UC patients[40], although studies specific to IPAA demonstrated no increased risk[41,42]. Several studies have failed to demonstrate an increased risk of infective complications with anti-integrin therapy[43,44], although one study demonstrated a strong trend towards more frequent intra-abdominal abscesses and mucocutaneous separation in pouch patients treated with vedolizumab compared with anti-TNFα agents[45]. The data regarding the peri-operative use of these agents in patients undergoing IPAA surgery thus remains inconclusive, and high-quality prospective trials are eagerly awaited.

Another point of controversy in IPAA surgery is with respect to the decision for temporary proximal diversion, which largely defines the difference between"one-", "two-", and "three-stage" pouch surgery. "One-stage" IPAA surgery refers to proctocolectomy and pouch formation without loop ileostomy; "two-stage" surgery refers to proctocolectomy and pouch formation with loop ileostomy followed by ileostomy reversal; and "three-stage" surgery is usually reserved for patients who present acutely with severe colitis where an initial subtotal colectomy is performed, followed by an interval completion proctectomy/IPAA and proximal diversion, thence followed by ileostomy reversal. In a survey of North American surgeons, 71% of the 575 surgeons reported that they would routinely choose to create a loop ileostomy[46]. The benefit of a temporary loop ileostomy appears logical in terms of avoiding pelvic sepsis; however, there is a paucity of evidence to demonstrate that proximal diversion improves outcomes after IPAA. Critics of proximal diversion would suggest that the risk of morbidity from their interim stoma and subsequent closure of their ileostomy would offset the benefits of diversion. Indeed, a high output ileostomy has been reported to affect approximately 10% of patients, often requiring early closure of their ileostomy[47]. Complications after closure of ileostomy are real, with postoperative morbidity reported to affect between 10 and 30% of patients[48-56].

There is a single small randomised trial that has sought to evaluate the outcomes of proximal diversion at the time of IPAA compared to a "one-stage" procedure[57].

Grobler *et al*[57] studied forty-five patients who were randomised to either a "one-" or "two-stage" pouch procedure. All the patients were steroid naïve at the time of surgery. Patients were randomised to the trial after an uncomplicated IPAA and a negative intraoperative anastomotic leak test. The results did not show any difference in the rate of septic complications between the two groups. However, the translation of these findings should be interpreted with caution as the study was small and demonstrated significantly greater number of females in the "one-stage" group compared to the "two-stage" group. The effect of this observed gender difference might have biased results, as it is perceived that pelvic dissection is often easier in females and therefore the subsequent risks of pelvic sepsis may be reduced compared to the narrow android pelvis of males. This study inadvertently highlights that patient selection is of great importance when considering a "one-stage" procedure.

A meta-analysis performed by Weston-Petrides *et al*[58] reviewed the literature, comparing the outcomes of RPC with and without ileostomy at a minimum follow-up of 12 mo. The analysis reviewed 1486 patients across 17 studies. 721 of these patients received a diverting ileostomy whilst the remaining 765 did not. The analysis found that the overall incidence of anastomotic leakage and pouch related sepsis was 7%. This was greatest in the group without ileostomy (odds ratio 2.37, 95% confidence interval 1.39-4.04, $P = 0.002$). There was no significant difference in the incidence of small bowel obstruction (SBO) between the two groups, and there was also no difference in the incidence of pouchitis between the two groups. It would appear, therefore, that meta-analysis supports the use of a routine diverting ileostomy, demonstrating improved short-term outcomes over that of the "one-stage" procedure.

Familial adenomatous polyposis

Classical FAP is a syndrome characterised by hundreds (and often thousands) of adenomatous polyps in the colon and rectum at a young age (usually by the third decade of life). It is a genetic condition based on a mutation in the adenomatous polyposis coli (APC) gene. There is a push nowadays for all at-risk patients to undergo genetic testing that serves two purposes: (1) To provide a genetic basis to aid diagnosis of the syndrome; and (2) To allow genotype-phenotype correlation which helps predict the clinical manifestations of the syndrome and guide appropriate management. Specifically, the site of the mutation in the APC gene influences the expression of FAP, and can help distinguish between "severe" and "attenuated" FAP[59].

Without prophylactic colectomy, the risk of colorectal cancer in FAP patients is almost 100%[60]. Once a diagnosis of FAP is made, either by genetic testing or endoscopic detection of polyposis, the aim is to offer prophylactic surgery before cancer develops. In patients who are symptomatic, surgery is usually indicated as soon as practical[60,61]. In most cases, however, it is preferable to defer surgery until such a time when its impact on social functioning and educational activities will be minimised[62].

As surgical options have increased, so has the debate surrounding the choice between them. The available options are: (1) Colectomy and ileorectal anastomosis (IRA); (2) RPC/IPAA; and (3) Non-restorative proctocolectomy. While proctocolectomy is considered by some to be routine choice for all FAP patients, this approach has been questioned of late[63], as it is increasingly recognised that selected patients with FAP may do better with a colectomy/IRA instead[59]. This is because in selected cases, the risk of developing rectal cancer is low, and the decision for colectomy/IRA is reasonable so long as rectal surveillance can be assured. This is relevant because functional outcomes in terms of bowel frequency and incontinence are more favourable with IRA than IPAA, and sexual and reproductive function can be adversely impacted with proctectomy. These are pertinent considerations for typically young patients who are otherwise healthy, and who are undergoing surgery for prophylaxis rather than treatment[60].

The decision for RPC/IPAA as opposed to colectomy/IRA therefore appears largely driven by the underlying genotype-phenotype correlation. For example, polyp burden has been demonstrated to predict future proctectomy risk. One study by Church *et al*[64] followed 94 patients with < 5 rectal adenomas and < 1000 colonic polyps who underwent IRA; after a median of 12 years, no patient required secondary proctectomy. Conversely, over one-third of 74 patients who had > 20 rectal polyps and underwent an IRA required interval proctectomy. Proctoscopic findings of < 5 rectal adenomas almost always correlates with mild disease, and in such cases, an IRA appears a reasonable surgical option[63].

APC genotyping can also aid in the surgical planning for FAP patients. The two genotypes that predict need for future proctectomy are: (1) Codon 1309 mutation; and (2) Codon 1328 mutation[65]. Patients carrying these mutations should have a RPC[61]. In the absence of these mutations, and in patients with: (1) No rectal cancer or advanced

rectal neoplasia (*e.g.*, large or high-grade tubulovillous adenoma); (2) Low polyp burden in the rectum (< 20 adenomas); and (3) No colon cancer or profuse colonic polyposis, a rectal sparing colectomy/IRA should be considered as a reasonable alternative[63]. Importantly, however, for rectal sparing surgery to be recommended, a rigorous rectal surveillance program must be adhered to, and if such a program seems impossible, an IPAA should be recommended, irrespective of the polyp burden or genetic profile of the syndrome[24].

CONTRAINDICATIONS TO THE ILEOANAL POUCH PROCEDURE

Contraindications to RPC/IPAA can be broadly classified as absolute and relative. Absolute contraindications include: (1) An incompetent anal sphincter mechanism[66]; (2) Emergency presentation with accompanying use of high-dose steroid[67]; and (3) Carcinoma of the low rectum requiring complete excision of the anorectum. Relative contraindications to RPC/IPAA include: (1) Crohn's disease; (2) IC; and (3) Primary sclerosing cholangitis (PSC). These contraindications are relative as they are associated with a higher incidence of postoperative morbidity and pouch failure.

Formation of an IPAA for Crohn's disease is generally contraindicated[66]. However, it continues to be performed, often inadvertently. In some cases where there is difficulty distinguishing between UC and Crohn's, the patient's histology is described as "indeterminate", although a subsequent diagnosis of Crohn's disease will be made in up to 15%[68]. Patients with IC or Crohn's disease exhibit a higher incidence of pouch failure compared to those with UC, with the incidence of pouch failure in this cohort ranging from 20% to 60%[69-71]. Contentiously, pouch failure rates as low as 10% have been published in Crohn's patients[72]. These studies, however, strictly selected patients whose inflammation was limited to the large bowel, and who had *no* small bowel or anoperineal disease. On this basis, current European Crohn's and Colitis/European Society of Coloproctology guidelines state that in carefully selected Crohn's patients with no history of perianal or small bowel disease, RPC/IPAA can be offered with expectation for a comparable quality of life to those with UC[73]. Generally speaking though, IPAA surgery in Crohn's patients is still treated with caution, and most clinicians would seek to avoid restorative surgery in patients with confirmed or suspected Crohn's disease[74].

By contrast, the majority of patients with IC are known to benefit from RPC/IPAA, although their risks of pouch failure are slightly higher than those with UC. One study showed that 27% of IC patients suffered from pouch failure compared to 11% in the UC group[68]. The higher rate in the IC group was largely attributed to the diagnostic conversion of 15% to Crohn's disease, with sub-analysis indicating that patients with true IC have a similar failure rate to those with UC. It would therefore appear that patients with IC are suitable candidates for pouch surgery[24], but should receive appropriate counselling of the surgical risks and the implications of subsequent conversion to Crohn's disease.

PSC is a chronic cholestatic liver disease of unknown aetiology, and is viewed as a relative contraindication to pouch surgery because of the increased risk of pouchitis (almost double that of the normal pouch population)[75-78]. Patients with PSC also exhibit high levels of perinuclear antineutrophilic cytoplasmic antibodies (p-ANCA). One study found that patients with UC who displayed high levels of p-ANCA prior to IPAA were more likely to develop pouchitis within 12 months of surgery compared to those who were p-ANCA negative (100% *vs* 56%)[79]. It has been postulated that preoperative p-ANCA levels may help to identify patients at risk of developing pouchitis[80], although this is not a widely adopted approach.

QUALITY OF LIFE FOLLOWING IPAA SURGERY

There are two concepts that relate to the achievement of a "good" quality of life for IPAA patients. The first and fundamental concept relates to the removal of disease burden. The second relates to the avoidance of a permanent stoma.

Kohler *et al*[81] compared the quality of life of patients after the various types of surgery for UC. The study evaluated three groups of surgical patients: Conventional proctocolectomy with end ileostomy (406 patients), Kock continent pouch (313 patients) and IPAA (298 patients). The study demonstrated that quality of life was greatest in those patients that received an IPAA and least in those with an end ileostomy. Pemberton *et al*[82] performed a prospective cohort study to evaluate and compare the functional outcomes and quality of life of 406 patients who had

undergone an abdominal proctocolectomy and Brooke ileostomy between 1966 and 1980 and 298 patients who underwent an IPAA between 1981 and 1988. The study demonstrated comparable satisfaction levels between both groups. However, the performance status (activity) of patients with an IPAA was greater than those with an ileostomy. These findings also translated to the patient's sexual functioning, with 30% of ileostomy patients reporting limited sexual functioning compared to 13% of patients in the IPAA group. The authors report that the majority of ileostomy patients were satisfied with their treatment, although 39% stated that they would desire a change from their current situation with a view to an alternative surgical option. From these two studies, it would appear that, despite removal of disease burden, the avoidance of a stoma remains of great importance to patients.

That said, it is interesting to note the disparity in quality of life outcomes following pouch surgery for FAP as opposed to UC. In keeping with UC patients, FAP patients are typically young. However, unlike the majority of patients with UC, FAP patients are often asymptomatic at the time of presentation. Heuschen *et al*[83] performed a prospective study of 34 patients (27 patients with UC and 7 with FAP). They aimed to compare the quality of life of patients before and after RPC, and again 1-year after closure of their ileostomy. They found that the patients' quality of life was significantly improved in the UC group after surgery. However, the converse was observed in patients with polyposis. Even after reversal of their ileostomy only a part improvement in their scores was observed. It would appear that patients with UC are sensitive to an improvement from their surgery owing to the removal of their disease burden. In comparison, patients with FAP, who are often asymptomatic at the time of their surgery, did not derive as obvious a benefit. This was reflected in their poorer scores. This studies' findings, which contrasts somewhat to that of Kohler *et al*[81] and Pemberton *et al*[82], would suggest that removal of disease burden, rather than restoration of intestinal continuity, is the major determinant in providing a better quality of life for the surgical patient.

COMPLICATIONS

The mortality rate for RPC/IPAA is low. Studies describe the rate to be between 0.2% to 1.5%[22,84]. This low mortality rate is largely because patients are typically young, healthy, and fit for major surgery. Further, operations are generally performed in tertiary centres on well-selected patients who have undergone appropriate pre-operative workup and counselling[85].

In distinct contrast to mortality, the IPAA procedure does have an appreciable morbidity which patients should be aware of before choosing the procedure. Early studies reported the incidence of major complications to be as high as 54%, but this has decreased to 19% in contemporary literature as experience in this surgery has increased[85]. A meta-analysis reported the most common pouch-specific complications following IPAA to be: Pouchitis (18.8%), pelvic sepsis (9.5%), stricture (9.2%), and fistula (5.5%)[23]. Morbidity following IPAA is traditionally classified into those which are "early" (within 30 d of surgery) or "late" (usually following closure of ileostomy) (Table 1).

Early post-operative complications

In the early postoperative period the main complications include haemorrhage, acute pelvic sepsis, and portal vein thrombus.

Haemorrhage: Postoperative haemorrhage may be either reactionary or delayed, and is usually related to the pouch staple line. It occurs in approximately 4% of patients following pouch surgery[86]. Following anastomosis, the pouch should be examined for any bleeding points, and if found, under-run. Persistent bleeding in the first 24 h requires examination under anaesthesia[87]. In some cases, pouch endoscopy may be required, during which clots are evacuated and the pouch irrigated with adrenaline solution[88]; occasionally, a single point of bleeding may be seen and under-run with a suture[87].

Less commonly, postoperative haemorrhage may be due to pouch ischaemia. The distinction is usually easy to make, as suture line bleeding is bright in colour, whilst blood from pouch ischaemia is darker red with clots[85]. Intra-abdominal bleeding that does not directly originate from the pouch may be from the colonic bed, the lateral pelvic walls, and/or the mesenteric vessels[87]. Finally, intramural hematoma of the pouch is a rare complication that can lead to pouch fibrosis and longer-term pouch dysfunction, due to development of a stiff non-compliant pouch[89]. In extreme circumstances, an intramural haematoma may be a prelude to an anastomotic leak; the patient should be commenced on broad-spectrum antibiotics, and a catheter

Table 1 Complications following ileal pouch anal anastomosis

Complications following IPAA
Early
Haemorrhage
Staple line bleeding
Pouch ischaemia
Intraabdominal bleeding
Intramural haematoma
Acute pelvic sepsis
Anastomotic leak
Infected haematoma
Portal vein thrombus
Late
Chronic pelvic sepsis
Pouch fistulae (pouch-vaginal, pouch-anal, pouch perineal)
Small bowel obstruction
Pouch dysfunction
Mechanical causes (obstruction/ pouch stricture, poor compliance)
Pouchitis
Cuffitis
Irritable pouch syndrome
Pouch failure
Dysplasia/malignancy
Cuff dysplasia
Pouch dysplasia
Infertility

IPAA: Ileal pouch anal anastomosis.

should be carefully placed transanally to effect adequate pouch decompression[87].

Acute sepsis: Evidence of acute sepsis in the early postoperative period should arouse suspicion of evolving pelvic sepsis. Early pelvic sepsis usually presents with fever, anal pain, tenesmus, and/or purulent discharge per anus. Alertness to this common postoperative complication is essential. Diagnosis is confirmed with cross-sectional imaging by computed tomography or magnetic resonance imaging, which may demonstrate an abscess or oedematous tissue planes.

Pelvic sepsis usually occurs as a result of an anastomotic dehiscence or the presence of an infected haematoma. Because patients who develop early pouch sepsis have a higher risk of subsequent pouch dysfunction and failure[90], an aggressive management approach is required. Prompt treatment maximises the chances of pouch preservation, whereas delayed therapy results in a stiff, non-compliant reservoir. Most patients respond to intravenous antibiotics, but patients with ongoing sepsis and an organised abscess should undergo early drainage, either transanally or by a radiology-guided percutaneous approach. If possible (and appropriate), a transanal approach is usually preferred, during which a Depezer or Malecot catheter is placed through the anastomosis to drain peripouch collections/abscesses[87]. Due to the potential risk of fistulation along the drain tract, trans-gluteal drainage should be avoided if possible[91].

If drainage of the cavity is inadequate with these measures, the abscess should be deroofed and the cavity curetted through the anus, thereby upsizing the communication between abscess and pouch. Several attempts may be needed to eradicate sepsis. Recently, endo-cavitational vacuum therapy (Endo-SPONGE®) has been embraced for the treatment of low pelvic leaks (Figure 2); first described for the treatment of anastomotic leak following anterior resection[92], its use has been borrowed for the treatment of anastomotic dehiscence post-IPAA, with encouraging results[91]. Rarely, an abdominal approach (re-laparotomy) is needed. If anastomotic dehiscence is recognised pre-ileostomy closure, ileostomy closure should be delayed until clinical and radiographic evidence of healing is achieved.

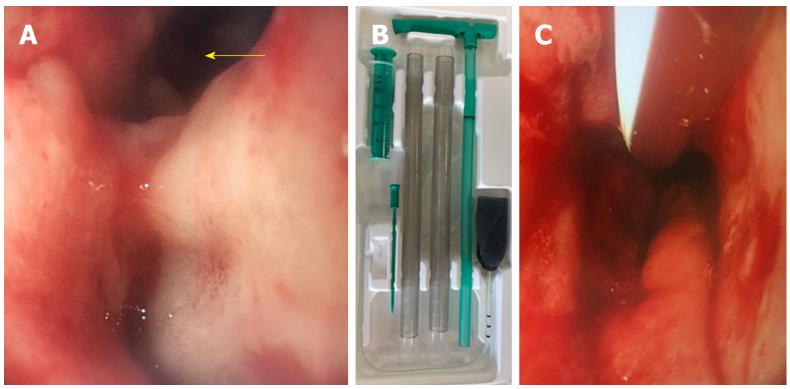

Figure 2 Endo-cavitational vacuum therapy (Endo-SPONGE®). A: Endoscopic view of a pouch with a cavity (arrow) at the anastomosis secondary to anastomotic leak. The true lumen is at the inferior aspect; B: Contents of the Endo-SPONGE® kit (B Braun Medical Ltd); C: The foam of the Endo-SPONGE® is passed into the cavity and negative pressure applied to collapse the cavity.

Portal vein thrombus: An association between portal vein thrombosis and inflammatory bowel disease (IBD) has been established[93,94]. Factors contributing to portal vein thrombosis following pouch surgery include the hypercoagulable state of IBD patients, the inflammatory response secondary to pouchitis/sepsis, and dehydration due to a high output stoma/pouch. Other factors include the need to mobilise small bowel mesentery to its root, which can potentially result in endothelial stretch and injury and a subsequent thrombotic cascade[95].

Portal vein thrombi have been documented to occur in up to 45% of patients following RPC/IPAA who undergo postoperative imaging[93]. This, of course, is a biased finding, as the proportion of patients with portal vein thrombi who do not undergo postoperative imaging is unknown. Most portal vein thrombi are asymptomatic, but may cause symptoms of abdominal pain, fever, nausea, or vomiting[87]. Thrombi are treated with anticoagulation for 3-6 months. Interestingly, with appropriate management, portal venous thrombi appear to have minimal impact on long-term pouch function or quality of life[96], although potential sequalae, such as portal hypertension and gastric varices, have not been thoroughly investigated[97].

Late post-operative complications

Chronic pelvic sepsis: Chronic pelvic sepsis is estimated to complicate 10%-20 % of IPAAs. This phenomenon may manifest in a number of ways, which include: (1) Pouch fistulae (pouch-anal, pouch-vaginal, pouch-perineal); (2) Anastomotic stricture; and (3) Poor pouch compliance with resultant poor function.

The reported incidence of pouch-vaginal fistula ranges from 7% to 10%[98,99]. Pouch-vaginal fistulae usually present with persistently abnormal (enteric) vaginal discharge, and diagnosis is confirmed by an examination under anaesthetic which demonstrates the fistula (Figure 3). Occasionally, a radiological contrast enema (pouchogram) is required to clinch the diagnosis. Importantly, a pouch-vaginal fistula should be excluded prior to ileostomy closure by careful examination of the vagina and anal canal[98]. Causative factors of pouch-vaginal fistulae include inadvertent injury to the vagina during rectal dissection, and anastomotic dehiscence with subsequent pelvic sepsis[100].

Management of pouch fistulae depends on the severity of symptoms. When symptoms are minimal, placement of a seton may be all that is required. In those with incontinence, proximal diversion with an ileostomy should be performed if not already present. At the time of de-functioning, sepsis should be adequately drained (with or without placement of a seton). Fistula repair can then be embarked upon when control of sepsis is achieved. Simple de-functioning alone does not usually lead to fistula closure[101].

Surgical options of pouch fistula repair are divided into abdominal and perineal procedures. Abdominal procedures include pouch revision with advancement of the ileoanal anastomosis. Perineal approaches include fistulectomy with or without sphincter repair, endoanal advancement flaps, or even transvaginal pouch repair. The height of the anastomosis is the critical determinant of the chosen operative approach: (1) Pouch-vaginal fistulae from an anastomosis at or above the anorectal junction should be approached abdominally with pouch dissection, repair of the vaginal defect, and refashioning of a new anastomosis[101,102]; while (2) A fistula arising from an anastomosis within the anal canal should not be treated with an abdominal procedure

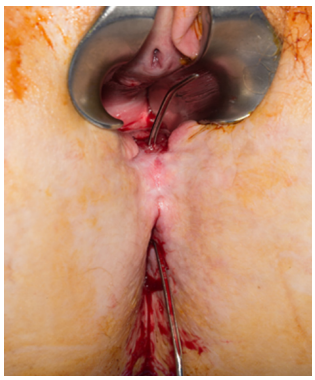

Figure 3 Examination under anaesthesia performed for a female patient who presented with perineal sepsis and abnormal per vaginal discharge following ileal pouch anal anastomosis. A pouch-vaginal fistula was identified and confirmed with a probe.

as there is insufficient anal canal length distally for re-anastomosis. A perineal approach is required in such circumstances, either by an advancement flap[98-100,103] or transvaginal technique[100,104,105].

Small bowel obstruction: SBO occurs in up to 30% of patients over 10 years, and can result from adhesions that form to the raw surfaces after colectomy and/or kinking at the ileostomy. Patients who undergo IPAA are at particularly high risk for SBO because of the extensive abdominal and pelvic dissection incurred during pouch surgery, the need for multiple (staged) operations, and a possibly higher septic complication rate compared with less complex procedures. In one study by MacLean *et al*[106], the cumulative risk of SBO was found to be 9% at 30 d, 18% at 1 year, 27% at 5 years, and 31% at 10 years. The need for surgical intervention for SBO was 1% at 30 days, 3% at 1 year, 7% at 5 years, and 8% at 10 years. It would appear, therefore, that while the risk of SBO after IPAA is high, most cases can be successfully managed without surgery.

Important factors predictive of SBO include use of a diverting ileostomy, stomal rotation 180° (as some authors advocated to reduce faecal spillage into the de-functioned pouch)[107], and need for pouch reconstruction[106]. Internal herniation, possibly even under the pouch mesentery, should not be forgotten as a potential cause of (usually early) SBO[108]. Intuitively, a lower incidence of SBO may be expected following laparoscopic pouch surgery due to a reduction in adhesion formation. This, however, is not supported by existing data, with one meta-analysis failing to demonstrate any difference in adverse event rates and long-term functional outcomes between open and laparoscopic pouch surgery[13]. In fact, with a totally laparoscopic approach, it has been argued that a 180° degree twist in the pouch can be readily missed; the resulting pouch "volvulus" has been known to cause SBO, noted only following closure of ileostomy (Figure 4).

Pouch dysfunction: Michelassi *et al*[109] performed a large prospective observational study of 391 patients with an IPAA. This seminal study reported the long-term functional outcomes of patients at a median follow-up of 34 (range 0 to 180) months. Based on the results of this study, which are in agreement with others performed on separate (and indeed, larger) cohorts[110,111], "normal" pouch function is usually defined by a 24-h stool frequency of four to eight motions per day with one nocturnal motion, and the ability to defer pouch evacuation until convenient[109]. Poor pouch function is therefore defined by deviation of the patient's median stool frequency from the normal, and/or an inability of the patient to maintain both diurnal and nocturnal continence.

The issue of pouch dysfunction is particularly important given its critical influence on patients' quality of life following surgery. While studies that have evaluated quality of life in the context of IPAA surgery have generally described the procedure as offering a "good" quality of life[112], this demonstrates close correlation with measured pouch function. For example, Tiainen *et al*[113] demonstrated that patients who exhibited good postoperative pouch function, had a quality of life comparable to that of healthy controls; in contrast, patients with poorer function (*i.e.*, frequent episodes of faecal incontinence and urgency) had a significantly poorer quality of life. There are a number of causes of poor function of the pouch, which can be categorised as: Mechanical; inflammatory (cuffitis, pouchitis); and septic (discussed above).

Mechanical causes of poor function of the pouch include: A small volume pouch, a

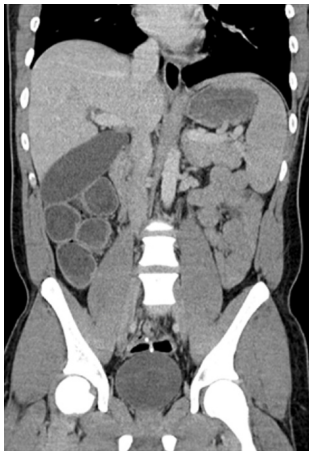

Figure 4 A coronal computed tomography image of a patient who presented with early small bowel obstruction following closure of ileostomy (6 mo post pouch creation). Computed tomography and operative findings confirmed small bowel obstruction secondary to a 360° twist at the level of the anastomosis.

poorly compliant pouch, a weak sphincteric complex, and pouch outflow obstruction. It is recognised that the manovolumetric characteristics of the pouch are linked to its resultant function[114,115]. A small, non-compliant pouch will promote faecal urgency and increased frequency[116]. A poor-quality sphincter complex with a weak-resting pressure can cause frequent small volume incontinence. Obstruction to pouch outflow usually occurs at the level of the anastomosis (Figure 5). Anastomotic stricture is estimated to affect 14% of pouch patients[86], and are usually related to a local complication such as undue tension of the anastomosis and local ischaemia (with or without subsequent anastomotic leakage). Full mobilisation of the mesentery to minimise traction on the reservoir is an important manoeuvre to avoid stricture formation. Interestingly, recent studies have demonstrated lower rates of stricture following stapled rather than hand-sewn anastomoses[117-120]. Web-like strictures can be easily broken with gentle passage of a finger, but such flimsy strictures rarely cause significant symptoms. More fibrotic strictures may also be fractured digitally but often require the insertion of graded dilators (bougie or Hegar) under anaesthesia[121]. On occasion, repeated dilatations are required, yet reasonable function can be expected in more than one-half of patients[104,122,123]. Some patients may require self-dilatation with an anal dilator on a daily basis, a practice that is usually well-tolerated by patients. The aim is to achieve a stable lumen diameter that admits an index finger to the level of the proximal interphalangeal joint, as this seems to correlate with reasonable function[87]. The longer the stricture, though, the less likely it is to yield to simple dilatation, and rarely, a transanal approach involving excision of the stricture and pouch advancement is required[124].

Cuffitis is an inflammatory condition of the residual rectal cuff, and may be related to the anastomosis being fashioned to the rectum rather than to the top of the anal canal (essentially an ileal pouch–rectostomy)[87]. Such an anastomosis therefore incorporates rectal tissue, which in UC patients poses risk of recrudescence of inflammation at the anastomosis[125]. Proponents of hand-sewn anastomoses would argue this condition occurs less with their anastomoses given a mucosectomy is routinely performed. Interestingly, the advent of laparoscopic pouch formation has been associated with an increase in patients coming to re-do surgery for long retained rectal cuff[126]; this is probably because cross-stapling of the anal stump remains challenging with current laparoscopic staplers and inadvertent proximal stapling of the distal rectum occurs instead. Cuffitis may respond to topical steroids, suppositories or 5-aminosalicylic acid preparations. In cases that prove resistant, the residual mucosa can be dissected off *via* a perineal approach, and mucosectomy is carried out from the dentate line to the anastomosis. The anastomosis is then disconnected circumferentially to permit delivery of the pouch down to the level of the anal verge. A new anastomosis is made with interrupted sutures[87].

Pouchitis is the most common complication associated with the IPAA, affecting 44% of patients at 10-year follow-up[127]. It is characterised clinically by the presence of crampy lower abdominal pain, general malaise, and increased stool frequency, often with the presence of bloody stools[128-130]. Studies suggest that pouchitis is most likely to occur within the first year after construction of the pouch[131], with the first episode typically occurring shortly after reversal of the ileostomy[132]. The time course of the condition varies from patient to patient, and may be classified into two distinct

Figure 5 Obstruction to pouch outflow usually occurs at the level of the anastomosis. A: A coronal computed tomography image demonstrating a pouch outlet stricture. A stricture at the level of the anastomosis (arrow) caused a dilated pouch that could not empty without intubation; B: A pouchogram of the same patient confirmed an anastomotic stricture that eventually yielded to serial Hegar dilations.

entities: acute pouchitis and chronic relapsing pouchitis. The aetiology of pouchitis remains unclear, but it is interesting to note that pouchitis does not appear to affect pouches formed for FAP[133]. The diagnosis of pouchitis requires a combined evaluation of clinical symptoms, endoscopic assessment of the pouch (Figure 6), and histopathology from pouch biopsies. A variety of scoring systems have been described to assess the severity of pouchitis[67,134-136], the best known of which is the pouch disease activity index[135] (Table 2). The treatment of pouchitis focuses on correction of a perceived bacterial dysbiosis[137], and patients are commonly prescribed ciprofloxacin or metronidazole[138-141]. Studies suggest that both antibiotic regimes are effective, but ciprofloxacin is usually better tolerated than metronidazole. Therefore, ciprofloxacin has largely become the antibiotic of choice. Some cases of pouchitis are refractory to antibiotics alone though. Recent reports have suggested that altering the pouch flora with probiotic bacteria may be an alternative or adjunct to antibiotic use[142-144], especially in patients with chronic pouchitis. Two probiotic agents have been studied in the context of pouchitis: VSL#3® and *Lactobacillus rhamnosus GG*. Randomised studies have identified that VSL#3® confers a remission rate of 85% over a median follow-up of 9[142] and 12 mo[143]. In patients with pouchitis refractory to antibiotic and probiotic therapy, other disease modifying drugs have been tried, with varying success. Recent reports have shown infliximab to be effective in the treatment of chronic pouchitis complicated by fistulous disease[145,146], although in a recent meta-analysis, anti-TNF agents appear to have most efficacy in Crohn's disease-like complications of the pouch rather than true refractory pouchitis[147]. Topical or oral mesalazine may also be of benefit in pouchitis[148], but 5-aminosalicylate therapy seems to have a greater role in the treatment of cuffitis rather than pouchitis[125]. Finally, while the prescription of steroids seems intuitive, there is a lack of evidence to support its use in pouchitis, either in oral or enema form.

Pouch failure: Pouch failure can be defined as the need for pouch excision or an indefinite defunctioning ileostomy. Early pouch failure is usually associated with pelvic sepsis, while later failure is related to pouch dysfunction or Crohn's 'conversion'[149]. The rate of pouch failure is between 5%-10%[150].

Much work has gone into predicting risk of pouch failure in individual patients. In an ileal pouch failure model[151] [often referred to as the Cleveland Clinic Foundation (CCF) ileal pouch failure score], patient diagnosis, prior anal pathology, abnormal anal manometry, patient comorbidity, pouch-perineal or pouch-vaginal fistula, presence of pelvic sepsis, and anastomotic stricture and separation were identified as independent predictors of pouch survival. The CCF pouch failure score is presented in Table 3, and remains a simple and accurate tool to predict the risk of pouch failure in clinical practice. Interestingly, the CCF pouch failure model does not identify pouchitis to be an independent risk factor, but the model is in keeping with findings of previous studies which have highlighted pelvic sepsis as a clear risk factor for poor pouch function[90,152].

Traditionally, pouch excision is the recommended management for the failed pouch, especially in patients for whom restoration of intestinal continuity is not pursued[152,153]. Such surgery is not without its burden though. In one study of patients undergoing pouch excision, 57% experienced short-term postoperative complications (most commonly a surgical site infection); 37% had long-term complications (most

Table 2 The pouch disease activity index

	Range
I Clinical	
1 Stool frequency	(0, 1, 2)
2 Faecal urgency/Abdominal cramps	(0, 1, 2)
3 Rectal bleeding	(0, 1)
4 Fever > 37.8 °C	(0, 1)
Maximal clinical sub-score: 6	
II Endoscopic finding	
1 Oedema	(0, 1)
2 Granularity	(0, 1)
3 Friability	(0, 1)
4 Loss of vascular pattern	(0, 1)
5 Mucous exudates	(0, 1)
6 Ulcerations	(0, 1)
Maximal endoscopic sub-score: 6	
III Histology-acute histological inflammation	
1 Polymorphonuclear infiltration	(0, 1, 2, 3)
2 Ulceration per low power field (mean)	(0, 1, 2, 3)
Maximal histological sub-score: 6	
Maximal total PDAI: 18	

PDAI: Pouch disease activity index.

commonly perineal wound issues)[154]. In fact, persistent perineal sinus following pouch excision has been associated with Crohn's disease, perineal dissection which leaves the external sphincter intact, chronic pelvis sepsis, and smoking, and may require formal sinus excision and transposition flap if unhealed with conservative measures[36].

Permanent ileostomy without pouch excision remains the obvious alternative. Moreover, favourable outcomes have been described following salvage surgery for pouch failure, including transanal pouch mobilisation/advancement, resection of an elongated pouch efferent limb, and re-do pouch surgery[103,155-162]. It should be borne in mind, however, that re-do pouch surgeries are complex procedures, performed infrequently, with most existing data based on retrospective series and heterogeneous groups of patients and their complications. A systematic review of salvage surgery after IPAA reported complications in almost one-half, a 74% "success rate" and an eventual 18% pouch excision rate after re-do pouch surgery[126]. Patients pursuing re-do pouch surgery should also be aware that functional outcomes after re-do surgery are inferior to those following "primary" IPAA formation, with higher rates of bowel frequency, urgency, and incontinence reported[36].

Finally, with the complexities of pouch excision and revisional surgery recognised, and with studies establishing a clear volume-outcome relationship in several aspects of IBD management[163], there has been a distinct push towards centralising the management of the failing pouch to higher volume centres. Patients with complications of pouch surgery including anastomotic leak and chronic pelvic sepsis are likely to achieve better outcomes if they are referred to a specialist centre with appropriate experience in managing such complications. Such observations have led to the ACPGBI consensus statement that appropriate referral to a sub-specialist unit should be considered for all IBD patients with complex or recurrent disease, including those requiring revision and excision pouch surgery[36]. Intuitively, this is related to the concentration of institutional experience in higher-volume centres when managing such specialised cases.

Dysplasia and malignancy: Initially, RPC/IPAA was thought to remove all tissue at risk of disease from UC and FAP, thus obviating the need for follow-up and removing the future risk of malignancy. However, dysplasia and cancer can still occur in the rectal cuff (or ATZ) and ileal pouch mucosa in both UC and FAP patients. The pathophysiology of dysplasia is completely different in these two diseases, though. In UC, persistent inflammation is the most important factor in progression to dysplasia, whilst in FAP, residual rectal and/or small bowel mucosa may undergo dysplastic

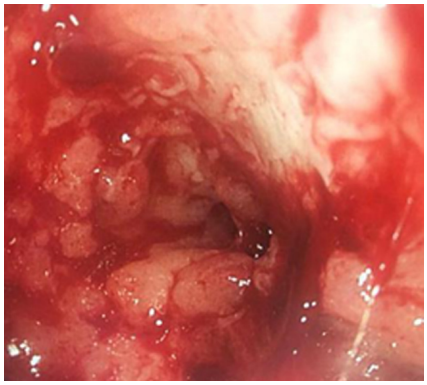

Figure 6 Endoscopic view of pouchitis (Pouch Disease Activity Index endoscopic sub-score 4).

change due to underlying genetic alterations associated with the disease; inflammation thus plays no part in this process[164].

The problem of cuff dysplasia relates to retention of islets of rectal mucosa, which inevitably occurs with a stapled anastomosis. Cuff dysplasia is a rare event though[165,166], and any retained rectal mucosa usually causes more problems with cuffitis than dysplasia. It should also be noted that patients with mucosectomy and hand-sewn IPAA are not "immune" to dysplasia or cuffitis, because islands of the rectal mucosa can regrow or may be inadvertently preserved due to incomplete mucosectomy; indeed, in one series, residual rectal mucosa was identified in 20% of patients who underwent hand-sewn IPAA with mucosectomy[167].

Pouch dysplasia is distinct from cuff dysplasia, and relates to pathological changes observed in the true reservoir mucosa. Such pathological changes described include chronic inflammation, crypt hyperplasia, and increased goblet cells. These features are akin to colonic metaplasia, and there is suggestion that colonic-like mucosa in the neorectum could be a potentially premalignant condition[85]. Indeed, neoplastic characteristics such as aneuploidy and different degrees of dysplasia have been reported in such "metaplastic" tissue[168], and pouch adenoma (Figure 7), and even adenocarcinoma (Figure 8), are well-documented entities, though overall rare.[169,170].

The potential risk of cuff or pouch dysplasia explains the rationale for careful follow-up and pouch surveillance of all patients after IPAA, which includes regular clinical and endoscopic examination of the ileal pouch and cuff. However, there is limited evidence for the ideal frequency of endoscopic surveillance. The British Society of Gastroenterology surveillance guidelines distinguish low risk (no high risk factors) and high risk (PSC, previous colorectal neoplasia, atrophic mucosa) groups following colectomy, and recommend surveillance intervals of 5 years and 1 year, respectively[171], but there is wide variation to this in daily practice[165].

IPAA and fecundity: Issues related to fertility, pregnancy, and the preferred method of delivery are of great importance to the female IPAA patient, particularly given that many are young and within their reproductive years. IPAA is associated with decreased female fertility[172-176], with approximately 40% having difficulty in conception following pouch surgery[174]. One study from Scandinavia compared the fecundity of women with FAP following colectomy/IRA versus IPAA; in that study, the fecundity of women following IRA was similar to that of the general population, but fecundity dropped to 54% following RPC/IPAA[177]. Preoperatively, young women should be counselled about the impact of pouch surgery on fecundity, and may decide to defer proctectomy until they have completed their family.

The significant decrease in postoperative fertility has been attributed to probable tubal occlusion from adhesions. One approach to circumvent this is the placement of an anti-adhesive membrane around the fallopian tubes and ovaries during surgery. Additionally, as laparoscopic surgery is associated with fewer adhesions, this approach may result in better preservation of female fertility[178,179]. Autonomic neuropraxia or inadvertent transection of the hypogastric nerves have also been suggested to lead to decreased lubrication and dyspareunia[180], contributing to decreased fertility postoperatively. Interestingly, a recent study has demonstrated that IPAA has minimal impact on male fertility[181].

The optimal method of delivery remains debated. Caesarean delivery decreases the risk of incontinence secondary to obstetric anal sphincter injury, but yet is associated with potential complications from abdominal surgery, including pouch injury. Vaginal delivery may cause pudendal nerve damage and injury to the anal sphincter

Table 3 The Cleveland Clinic Foundation ileal pouch failure score

Risk factor	Points
Diagnosis	
FAP	0
UC or indeterminate colitis	1
Crohn's disease	1.5
Patient co-morbidity	
No comorbid conditions	0
1 comorbid condition	0.5
2 or more comorbid conditions	1
Prior anal pathology	
No prior anal pathology	0
Prior anal pathology	1
Anal sphincter manometry	
Normal manometry	0
Abnormal manometry (squeeze pressure < 100, resting pressure < 40)	1
Anastomotic separation	
No anastomotic separation	0
Anastomotic separation	1
Anastomotic stricture	
No stricture or asymptomatic stricture	0
Symptomatic stricture	1
Pelvic sepsis	
No sepsis	0
One episode of pelvic sepsis	1
Two or more episodes of pelvic sepsis	2
Fistula formation	
No fistula	0
Pouch-perineal fistula	1
Pouch-vaginal fistula	2
TOTAL score	

This score is interpreted based on the number of years post pouch formation, and a probability of pouch failure is then calculable (www.riskprediction.org.uk/index-ccfipf.php). FAP: Familial adenomatous polyposis; UC: Ulcerative colitis.

mechanism, but minimises the risks associated with abdominal surgery. Indeed, studies have shown vaginal delivery to be safe after IPAA[182]. The decision regarding mode of delivery is made on an individualised basis after discussion with the patient. Many patients (and clinicians) will opt for an elective Caesarean section rather than risk compromise of pouch function.

CONCLUSION

RPC/IPAA has undergone significant modification since its introduction in 1978, and future directions of research in pouch surgery must include the robust assessment of novel techniques, including robotic surgery, SILS, and TaTME. The two primary indications for IPAA are UC and FAP, with the majority of pouches being fashioned for UC. In any case, the aim of IPAA surgery is the same: to definitively cure disease and prevent malignant degeneration, while providing adequate continence and avoiding a permanent stoma. The majority of patients experience long-term success with an ileal pouch, but this procedure is associated with significant morbidity. Complications following IPAA surgery can be grouped into those which are "early" and "late". Pelvic sepsis is a common early complication with far-reaching consequences in terms of long-term pouch dysfunction, but a high index of suspicion and prompt radiological or surgical intervention significantly reduces the chance of ultimate pouch failure. Even in the absence of sepsis, pouch dysfunction is a long-

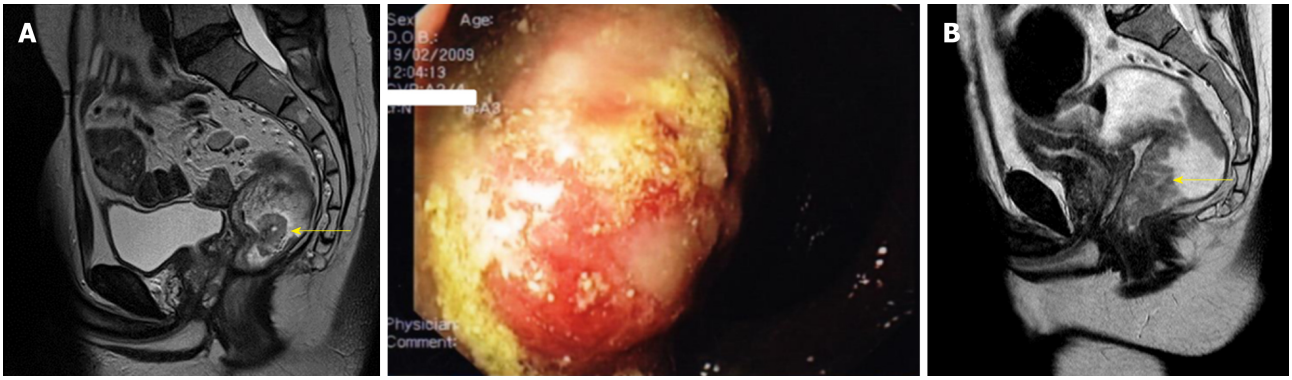

Figure 7 Pouch adenoma. A: Magnetic resonance image and endoscopic view of a pedunculated pouch polyp (arrow) arising in the mid pouch that was completely excised endoscopically; B: A serrated, near circumferential, lesion (arrow) that required formal pouch excision. Both pouch lesions were confirmed histologically to be pouch adenomas.

term complication that may have a myriad of underlying causes. Pouchitis is one common cause that remains incompletely understood and at times, difficult to manage. Other causes of dysfunction include impaired pouch mano-volumetry, pouch/anastomotic stricture, and cuffitis. 10% of patients succumb to the diagnosis of pouch failure, which is traditionally associated with the need for pouch excision. Finally, as the follow-up period following pouch surgery lengthens, the incidence of unique complications such as pouch dysplasia and malignancy can be expected to increase. The best management and surveillance strategies for such clinical entities remains unclear, but emerging evidence from this burgeoning field of research should help guide future clinical practice.

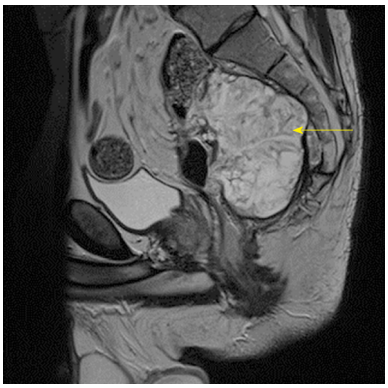

Figure 8 A magnetic resonance image of a pouch with a large exophytic lesion (arrow) arising from its posterior aspect. Biopsies and formal histopathology confirmed this to be a pouch carcinoma.

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