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ORIGINAL ARTICLE

Ileal pouch-anal anastomosis for ulcerative colitis: long-term outcomes and trends over time in a low-volume institution

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Abstract

Background Ileal pouch-anal anastomosis (IPAA) can restore bowel continuity for patients with ulcerative colitis (UC) who have needed total colectomy with end ileostomy. Internationally, this surgery is recommended for centralisation focussing reflection on Irish outcomes.

Methods Retrospective study examining patient outcomes after IPAA in our institution over a 15-year period using data from inflammatory bowel disease database, HIPE codes and clinical charts review between January 2002 and January 2018. Cohorts were analysed overall and in 5-year cohorts as well as by access modality of pouch operation. Contextualising Irish data were identified from published literature review.

Results Thirty-four patients (average age 34.8, 21/64% male) had IPAA for UC locally with 64-month mean follow-up. Overall laparoscopic procedure rate was 39.4% (85% 2013–17) being associated with lower lengths of stay (10.6 ± 8 vs 12.7 ± 6.5 days open access). The mean total duration of ileostomy was 27.3 ± 22.5 months, being longest most recently and with an open index procedure. Overall pouchitis affected 53% ($n = 18$) with rates at 1, 5, 10 and 15 years being 17.6%, 38.2, 50.0% and 52.9%, respectively. Pouch failure rates at 1, 5 and 10 years were 2.9%, 11.8% and 17.6%. Outcomes were similar with other centres publishing from Ireland although none met modern criteria for high-volume practice.

Conclusions Overall outcomes and practice in this study are consistent with previously published studies on IPAA nationally and internationally. While acceptable, the opportunity from surgical centre collaboration outside of the National Cancer and Acute Surgery Strategies is to offer still better outcomes for our patients.

Keywords Colectomy · Ileal pouch-anal anastomosis · Ulcerative colitis

Introduction

Ulcerative colitis (UC) is a chronic idiopathic inflammatory disease of the rectum and colon [1, 2]. In Ireland, its incidence is 14.8 per 100,000 population with a peak age of onset between 15 and 35 years [3]. The goal of therapy is to induce and maintain remission. When the condition is refractive to medical treatment, colectomy is required [4]. Surgery is also needed in those patients who develop neoplasia of their colorectum [5]. Surgical resection of the colon and rectum (panproctocolectomy) is done in approximately 15% of patients, the majority of whom have symptoms uncontrollable medically [4].

Ileal pouch-anal anastomosis (IPAA) is a procedure following proctocoloectomy that restores bowel continuity and prevents the need for a permanent ileostomy in these patients [6]. IPAA was devised by Parks and Nicholls in 1978, initially with an S-shaped ileal reservoir and revised over the following years [7]. The current standard is a J-pouch that is double-stapled above the dentate line without mucosectomy and is increasingly performed laparoscopically [8]. Restorative surgery for UC can be a two- or three-stage procedure. Stage 1 consists of a subtotal colectomy and end ileostomy. Stage 2 involves proctectomy, J pouch formation, ileal pouch-anal anastomosis and loop ileostomy. Stage 3 involves reversal of loop ileostomy.

IPAA has a high morbidity rate and technical factors definitely play a role. The most common late complication is

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pouchitis, a non-specific inflammation of the remaining ileal reservoir that results in both local and systemic symptoms and can cause misery [9, 10]. Pouchitis needs to be confirmed by endoscopic and histologic findings as symptoms alone are not fully reliable [11]. Rates of pouchitis in the literature range from 20 to 60% and increase with time [12–16] with chronic pouchitis occurring in 5–10% of patients [17]. Chronic pouchitis and pelvic sepsis can lead to poor pouch function and quality of life. Pouch failure defined as the need for a permanent ileostomy (with or without pouch excision) is a consequence of poor pouch function and quality of life. Pouch failure rates from 5 to 17% have been reported and again are time dependent [18–22]. High-volume centres (≥ 8.4 procedures annually) have significantly less pouch failure than low-volume centres (0.1–3.3 procedures annually) [23]. Based on this and other experiences [24], European guidelines recommend the centralisation of IPAA surgery into centres that perform at least 10 pouches annually.

Our institution is located in a country with a small population, and so, relatively small numbers of IPAA surgeries are performed compared to other larger EU countries. IPAA surgery is not centralised in Ireland so this operation is performed in several colorectal centres annually. The purpose of this retrospective study was to assess the outcomes of IPAA done for medically refractory UC in our institution over a 15-year period. The primary goals were to determine pouchitis and pouch failure rates, to examine for trends in care over time and to compare these to outcomes in the literature. Secondarily, the case for centralisation of IPAA surgery in Ireland is considered.

Materials and methods

Study group

We conducted a retrospective review of our centre's patient's outcomes after IPAA for UC over the period January 2002 to January 2018. Patients having IPAA were identified by studying our Hospital In-Patient Enquiry (HIPE) database (using the following International Statistical Classification of Diseases and Related Health Problems (ICD) 10th edition 32015-00 total proctocolectomy with ileostomy, 32051-00 total proctocolectomy with ileo-anal anastomosis, 32051-01 total proctocolectomy with ileo-anal anastomosis and formation of temporary ileostomy, 32009-00 total colectomy with ileostomy, 32009-01 laparoscopic total colectomy with ileostomy, 30562-01 closure ileostomy with restoration of bowel continuity, without resection) [25], our Gastrointestinal Unit database (identifying patients with UC refractive to biological treatment) and surgeon and operating room theatre logs. Once identified, clinical records were obtained. Once confirmed as having IPAA for UC patient, charts were data-mined for operative and clinical course information both regarding inpatient and outpatient attendance and including correspondence from primary care. Patients having IPAA for polyposis and/or those with Crohn's or indeterminate colitis were excluded.

The following definitions were used to record complications:

Early post-operative complications were those that occurred within the same admission for IPAA. *Late complications* were any occurring after discharge for IPAA in-patient stay. *Pouchitis* = a clinical presentation with the presence of the following three conditions: classical symptoms, abnormal endoscopy and histological confirmation. *Pouch failure* = a conversion to a permanent ileostomy, with or without pouchectomy. *Pouch revision* = requiring more than one operation on the IPAA, with or without a period of defunctioning ileostomy and a now functioning IPAA. *Anastomotic stricture* = a narrowing of the anastomosis on digital rectal examination that needed dilation (inc. as an outpatient).

Statistical analysis

Statistical analysis was performed using SPSS version 24.0 (SPSS, Chicago, Illinois, USA) on the study group. Categorical variables were analysed using frequency tables and comparisons were made using Fisher's exact test. Quantitative variables were analysed using independent *t* test or Mann–Whitney *U* test where appropriate. All tests were two-tailed, and for tests of significance, $p < 0.05$ was considered statistically significant.

Results

Thirty-four patients (22/64% male) with UC were identified as having undergone IPAA during the study period (mean 2.3 IPAA per annum) (see Table 1 for patient demographics overall as well by 5-year interval and by surgical access). Twenty-eight (82%) patients have been seen in the previous 12 months and the average follow-up length is 64 months. The mean total age at IPAA was 34.8 ± 13.5 years. The mean length of time from diagnosis to surgery overall was 6.0 ± 5.7 years. The majority of patients underwent IPAA in a three-step procedure and had a stapled anastomosis (30 (91.0%) and 32 (94.1%), respectively). The primary indication for elective colectomy (stage 1) was medically refractory disease (30 patients/88.2%). The other four patients were urgent/emergent due to toxic megacolon. One death was recorded but was unrelated to IPAA or UC.

Looking at changes in care over the study duration, some trends are evident. Most obvious is the predominance of laparoscopic surgery in recent years being first performed in

Table 1 Patient demographics (A) overall and by 5 year time periods and (B) whether IPPA surgery was performed by open or laparoscopic access

A		**Median ± SD where appropriate (% of total in each time period)**			
		2002–2007	**2008–2012**	**2013–2018**	**Total**
Patients		9	12	13	34
Male		3 (33.3)	9 (75)	10 (76.9)	22 (64.7)
Female		6 (66.7)	3 (25)	3 (23.1)	12 (35.3)
Smoker		4 (44.4)	2 (16.7)	2 (15.3)	8 (23.5)
Age at IPAA	Years	30.2 ± 14.8	40.4 ± 14.1	32.6 ± 10.9	34.8 ± 13.5
Disease to IPAA	Years	4.3 ± 3.5	6.9 ± 7.1	6.4 ± 5.7	6 ± 5.7
Length of stay	Days	10.2 ± 4.3	16.2 ± 9.4	9.0 ± 2.5	11.9 ± 6.9
Albumin at IPAA		38.2 ± 3.2	36.7 ± 3.5	38.4 ± 3.8	37.7 ± 3.5
Platelets at IPAA		313.9 ± 77.1	385.0 ± 95.3	254.0 ± 41.2	325 ± 95.2
Haemoglobin at IPAA		13.3 ± 1.5	13.0 ± 1.2	14.1 ± 1.7	13.5 ± 1.5
Open		9 (100)	8 (66.7)	3 (25)	
Laparoscopic		0	4 (33.3)	10 (76.9)	
Stapled IPAA		9 (100)	10 (83.3)	13 (100)	32 (94.1)
Hand-sewn IPAA		0	2 (16.7)	0	2 (5.9)
Post-operative drains		9 (100)	9 (75)	11 (84.6)	28 (82.4)
Colectomy–IPAA	Months	21.9 ± 32.1	11.8 ± 5.7	26.6 ± 15.0	19.8 ± 20.6
IPAA–ileostomy closure	Months	5.9 ± 4.8	6.3 ± 6.2	7.2 ± 3.0	6.5 ± 4.8
Duration of ileostomy	Months	27.1 ± 32.7	20.6 ± 10.3	35.0 ± 16.2	27.3 ± 22.5
B		**Median ± SD where appropriate (% of total in each intervention)**			
		Open	**Laparoscopic**	**Total**	
Patients		20	14	34	
Male		14 (70.0)	8 (57.1)	22 (64.7)	
Female		6 (30.0)	6 (46.1)	12 (35.3)	
Smoker		8 (40.0)	0	8 (24.2)	
Age at IPAA	Years	35.4 ± 14	33.9 ± 13.4	34.8 ± 13.5	
Disease to IPAA	Years	6.3 ± 6.3	5.2 ± 4.8	6 ± 5.7	
Length of stay	Days	12.7 ± 6.5	10.6 ± 8	11.9 ± 6.9	
Albumin at IPAA		37.8 ± 3.7	38.1 ± 2.7	37.7 ± 3.5	
Platelets at IPAA		328.8 ± 87.8	310.8 ± 111.3	325 ± 95.2	
Haemoglobin at IPAA		13.5 ± 1.4	13.5 ± 1.6	13.5 ± 1.5	
Stapled IPAA		19 (95.0)	13 (92.9)	32 (94.1)	
Hand-sewn IPAA		1 (5.0)	1 (7.1)	2 (5.9)	
Post-operative drains		18 (90.0)	10 (71.4)	28 (82.3)	
Colectomy–IPAA	Months	19 ± 22.4	21.4 ± 17.1	19.8 ± 20.6	
IPAA–ileostomy closure	Months	6.9 ± 5.5	5.8 ± 3.3	6.5 ± 4.8	
Duration of ileostomy	Months	26.2 ± 24.5	29.9 ± 16.8	27.3 ± 22.5	

2008 and accounting for 77% of cases between 2013 and 2018. Those undergoing laparoscopic pouch formation were broadly similar to those having open pouch surgery in terms of age, duration of disease before surgery and condition at time of surgery. Patients having laparoscopic surgery had less post-operative drains and shortened both length of hospital stay (10.6 ± 8 vs. 12.7 ± 6.5 days) and time to stage 3 (defunctioning stoma closure) (5.8 ± 3.3 vs. 6.9 ± 5.5 months). Notable differences over the timeframe studied included the mean time between diagnosis and index surgery lengthening (6.4 ± 5.7 years in 2013–2018 versus 4.3 ± 3.5 years in 2002–2007). Patients in the period 2013–2018 had both the longest duration of ileostomy overall and time from IPAA to ileostomy closure (35.0 ± 16.2 and 7.2 ± 3.0 months, respectively). Time with ileostomy (20.6 ± 10.3 months) was shortest in 2008–2012 while the lowest time between IPAA and ileostomy closure was 2002–2007 (6.9 ± 4.8 months). The difference in mean times from colectomy to IPAA has also lengthened going from 11.8 months in the period 2007–2013 to 26.6 months in 2013–2018. Length of stay was lowest in the current 5-year period 2013–2018 (9.0 ± 2.5) compared to 2008–2012 (16.2 ± 9.4) and 2002–2007 (10.2 ± 4.3).

Post-operative complications

Early complications were as follows: deep vein thrombosis in two patients (5.9%), small bowel obstruction or ileus in four (11.8%), wound infections in two (5.9%) and pneumonia in one (2.9%). Late complications were divided into pouch-related and pouch-unrelated. Pouch-unrelated late complications observed were small bowel obstruction or ileus in four (11.8%), incisional hernia in two (5.9%), wound infection in four (11.8%) and impotence in two (9.1%). Pouch-related late complications observed were cuffitis in three (8.8%), anal stricture in four (11.8%), pouch fistula in three (8.8%), perianal abscess in four (11.8%) and anastomotic leak in two (5.9%).

Perianal fistulae

There were four (11.8%) de novo perinanal fistulae. All were examined initially with MRI and then examination under anaesthesia (EUA) to further assess the fistulae.

Pouch revision

Two (5.9%) pouches were revised. A trans-abdominal approach was used and both patients have retained their pouch

Pouchitis

The incidence of pouchitis and pouch failure rates are shown in Tables 2 and 3. There were 18 cases of pouchitis recorded (52.9%) with a mean time to first diagnosis being 40.8 ± 41.8 months. Our pouchitis rates at 1, 5, 10 and 15 years were 17.6%, 38.2%, 50.0% and 52.9%, respectively. Patients having open IPAA formation had a higher incidence of pouchitis than laparoscopic techniques (65.0% vs. 35.7%) although those having laparoscopic surgery had a lower mean time to first episode (14.8 ± 10.3 vs. 50.8 ± 45.8 months). The percentage incidence of pouchitis was lowest in 2013–2018 (38.5% vs. 58.3% 2008–2012 vs. 66.6% 2002–2007) which also had the lowest mean time to first episode of pouchitis (15.0 ± 10.4 vs. 35.1 ± 31.2 vs. 69.0 ± 54.9 months).

Pouch failure

Pouch failure occurred in six patients (17.6%) with mean time after surgery being 46.7 ± 43.6 months. One-, 5- and 10-year failure rates were 2.9%, 11.8% and 17.6%, respectively. Fifty percent ($n = 3$) reverted to stoma for poor pouch function, due to sustained frequency with two out of three experiencing pouchitis (with concomitant poor quality of life). Other failures were due to perianal fistulation ($n = 1$), adhesional obstruction ($n = 2$, with one patient requiring emergency pouchectomy adhesion-related strangulation, the other adhesion-related failure due to recurrent obstruction and poor pouch function). No pouch failures were attributable to cuffitis and all patients had assessment of the rectal stump/IPAA including endoscopic assessment prior to decisions to divert rather than perform redo IPAA. Patients having laparoscopic surgery had a higher incidence of pouch failure than open techniques (28.6% vs. 10.0%) with also a shorter time to occurrence (43.5 ± 45.4 vs. 53.0 ± 56.6 months). The percentage of pouch failure was lowest in 2013–2018 compared to 2008–2012 or 2002–2007 (7.7% vs. 25.0% vs. 22.2%) which also had the lowest mean time before this complication (2002–2007 had the highest mean time until pouch failure (22 vs. 50.7 ± 52.8 vs. 53.0 ± 56.6 months).

Risk factors for complications

Possible patient characteristics known as predictors of pouchitis or pouch failure in previous studies were investigated for any associations to these complications in our study group. None of those tested were predictive in our data set (Table 4).

Table 2 Pouchitis and pouch failure rates (open vs laparoscopic)

	Pouchitis			Pouch failure		
	N (% total in each intervention type)		*N* (% total 34 cases)	*N* (% total in each intervention type)		*N* (% total 34 cases)
	Open	Laparoscopic	Total	Open	Laparoscopic	Total
Number of patients	13 (65.0)	5 (35.9)	18 (52.9)	2 (10.0)	4 (28.6)	6 (17.6)
Time to complication (months)	50.8 ± 45.8	14.8 ± 10.3	40.8 ± 41.8	53.0 ± 56.6	43.5 ± 45.4	46.7 ± 43.6
Complication at:						
1 year	3 (15.0)	3 (21.4)	6 (17.6)	0	1 (7.1)	1 (2.9)
5 years	8 (40.0)	5 (35.7)	13 (38.2)	1 (5.0)	3 (21.4)	4 (11.8)
10 years	12 (60.0)	5 (35.7)	17 (50.0)	2 (10.0)	4 (28.6)	6 (17.6)
15 years	13 (65.0)	5 (35.7)	18 (52.9)	2 (10.0)	4 (28.6)	6 (17.6)

Table 3 Pouchitis and pouch failure rates (time periods)

	Pouchitis				Pouch failure			
	N (% total in each intervention type)			*N* (% total 34 cases)	*N* (% total in each intervention type)			*N* (% total 34 cases)
	2002–2007	2008–2012	2013–2018	Total	2002–2007	2008–2012	2013–2018	Total
Number of patients	6 (66.7)	7 (58.3)	5 (38.5)	18 (52.9)	2 (22.2)	3 (25.0)	1 (7.7)	6 (17.6)
Time to complication (months)	69.0 ± 54.9	35.1 ± 31.2	15.0 ± 10.4	40.8 ± 41.8	53.0 ± 56.6	50.7 ± 52.8	22	46.7 ± 43.6
Complication at:								
1 year	1 (11.1)	2 (16.7)	3 (23.0)	6 (17.6)	0	1 (8.3)	0	1 (2.9)
5 years	3 (33.3)	5 (41.7)	5 (38.5)	13 (38.2)	1 (11.1)	2 (16.7)	1 (7.7)	4 (11.8)
10 years	5 (55.6)	7 (58.3)	N/A	17 (50.0)	2 (22.2)	3 (25.0)	N/A	6 (17.6)
15 years	6 (66.7)	N/A	N/A	18 (52.9)	N/A	N/A	N/A	N/A

Discussion

IPAA surgery is complex. While it technically evolved quite considerably early after its inception (for example double stapling replaced hand-sewn anastomoses with reduced pelvic sepsis rates [8]), the operation in the twenty-first century has largely reached steady state and is predominantly delivered by laparoscopy. Good functional outcomes have been obtained for many but pouchitis and pouch failure rates have remained relatively high and both undermine the goal of the IPAA endeavour, which is the restoration of reasonable bowel function with cure of the proctocolitis. To improve outcomes further, the main recent focus worldwide has been on centralisation of patients to high-volume centres (≥ 8.4 procedures annually) to allow greater specialisation among the entire clinical team to improve long-term functional outcomes and better address of those with problems. In the analysis by Burns et al. [23] on the effect of volume on outcomes in 5771 IPAA procedures over a 12-year period in England, lower volume centres (< 2 cases/year, 30% of all IPPA cases) had higher pouch failure rates than higher volume centres (> 8.4 cases per year, 32% of all IPAA cases). Parc et al. showed that outcome and mortality were better in centres that performed more than 10 IPAA suggesting that IPAA surgery should be limited to institutions that perform > 3 cases per annum [26]. Similarly in Canada, a study of 1285 IPAA surgeries showed pouch excision rates four times higher in low- and medium-volume hospitals compared to high-volume hospitals with both reoperation and readmission rates showing a similar trend [27] (the latter also replicated elsewhere [28]). On this basis, recent European guidelines recommend the centralisation of IPAA surgery into centres performing at least 10 pouches annually [24].

Our annual average of 2.3 IPAA for ulcerative colitis by four surgeons (additional patients have the procedure for polyposis but were excluded in this analysis) fits most recent thresholds of low volume. Our rates of pouchitis and pouch failure are within the ranges of previously published data with some of higher range figures coming from centres performing IPAA more commonly (indeed up to 113/cases per annum [16]). Clearly, though there is room for improvement, the overall pouchitis rate in our study was 52.9% ($n = 18$) with a similar rate at 10 years (50%) as at 15 years (53%). While higher than some reports in the region of 34% [16], pouchitis rates at different time intervals reported elsewhere give context to our figures: 9.5% [29] and 18% [30] at 1 year; 32.3% [29] at 5 years; 34% [16], 44.2% [27] and 48% [13] at 10 years and 60% [14] and 70% [13] at 20 years. In the present study, 17.6% ($n = 6$) of pouches failed, half of which were due to pouch dysfunction. Our pouch failure rates at 1, 5 and 10 years were 2.9%, 11.8% and 17.6% again similar to numerous other series that have also reported their rates over time: at 1 year: 2% [18]; at 5 years: 4% [13], 5% [30], 7.7% [31], 8.5% [18] and 9% [21, 22, 32]; at 10 years: 6% [13], 9% [30], 11.3% [31],12.1% [20], 13% [32] and 16% [21] at 15 years: 15.5% [31]; and at 20 years: 18.2% [20]. The statistics related to laparoscopic surgery are interesting and may be partially explained through subgroup analysis by time period. The highest

Table 4 Pouchitis and pouch failure predictors

	Pouchitis *p* value	Pouch failure *p* value
Gender	0.07	0.16
Smoking	0.69	N/A
Age at IPAA	0.08	0.09
Open/laparoscopic	0.30	0.18
Albumin at IPAA	0.70	0.23
Platelets at IPAA	0.17	0.20
Haemoglobin at IPAA	0.39	0.27
Duration of ileostomy	0.39	0.15

rates of pouch failure were seen early after commencement of laparoscopic access for this operation (February 2008). This maybe because the majority of IPAA in this study were performed less than 43.5 months ago (the mean time to pouch failure is > 50 months). A possible explanation is the presence of a long rectal cuff which is a concern when dividing the rectum laparoscopically. However, this was not found on postoperative investigations including reoperations. A more likely alternative explanation is the presence of a learning curve bias and the increase in familiarity of laparoscopic IPAA since then.

Our results are broadly similar to other Irish institutions publishing their results. Browne et al. performed a retrospective study on 42 IPAA patients over an 11-year period (a similar time period, population and patient cohort as ours) [15]. They observed an overall pouchitis rate of 49% being 42.1% and 56.3% in laparoscopic and open surgery, respectively. Martin et al. reported a pouchitis rate of 31% in their study on 41 patients over a 5-year period but did not report longer-term outcomes [33]. Notably, no Irish centre reporting its outcomes meets the standard of high volume by international criteria and standards (average case load being 8.2 [33], 4 [34], 3.8 [15] and 2.3) [23]. Taking all the figures together, however, it can be seen that high-volume centres are possible in this country whether as one large national centre or two or three regional centres. While one Irish centre is already close to meeting a 10 annual case load, it is interesting to note how some of our process metrics deteriorated in the associated national strategy to prioritise cancer work at our institution, a trend likely replicated in all other cancer centres. This suggests that access may be difficult for non-cancer operations at our national centres suggesting that IPAA surgery may be better sited in a non-cancer centre but still one equipped to perform major surgery and manage complications. As noted elsewhere [23], centralisation can raise issues needing consideration, for instance a registrar may be trained in a high-volume centre but move to a low-volume centre as a consultant and indeed vice versa. It may so be best to allow mobility of surgeons interested in developing specialists' skills to the centre/centres. Alongside patient outcomes, there would also likely be benefits to our national training in this operation, better developing future colleagues in tandem with dedicated training away for selected individuals.

Additionally, we do see changes in clinical course over time. The mean age of patients having IPAA has increased and LOS has decreased. The longer time from diagnosis to colectomy in recent years suggests that UC is better medically controlled now (biological drugs for UC were introduced c 2005). This may account too for the differences in time between diagnosis and IPAA surgery between the time periods being highest in 2013–2018. The total mean length of ileostomy is 27.3 ± 22.5 months, the highest duration again being most recently (2013–2018:35.0 ± 16.2 months). Pouchitis and pouch failure incidence were lowest in the most recent time period, which may suggest that more experience in performing IPAA surgery, particularly laparoscopically has led to lower morbidity or the follow-up period has been too short for these complications to present or a mixture of both.

The main limitations of this study are the small sample size and its retrospective nature. All information was obtained from the institutional database, and in some cases, relevant information was missing despite our best efforts. It is possible that some extra cases are missing but we believe very few and not enough to alter the general findings and their interpretation.

In conclusion, overall IPAA is a safe procedure with acceptable functional outcomes over time. The incidence of pouchitis and pouch failure in this study is consistent with the upper range of previously published studies on IPAA. However, with increasingly robust evidence that high-volume centres performing IPAA have significantly lower morbidity than low-volume centres, we note that a centralised high-volume centre is numerically feasible in Ireland and the next step is to work towards developing this vision with all interested. We know that centralisation is possible for complex surgery for rectal cancer [35], pancreas cancer and liver transplant (the latter actually being more commonly performed then IPAA [26]) and that better outcomes can accrue for these patients nationally.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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