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ORIGINAL ARTICLE

What is the rate of definitive stoma after subtotal colectomy for inflammatory bowel disease? A nationwide study of 1860 patients

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Abstract

Aim: Some patients with inflammatory bowel disease (IBD) require subtotal colectomy (STC) with ileostomy. The recent literature reports a significant number of patients who do not undergo subsequent surgery and are resigned to living with a definitive stoma. The aim of this work was to analyse the rate of definitive stoma and the cumulative incidence of secondary reconstructive surgery after STC for IBD in a large national cohort study.

Method: A national retrospective study (2013–2021) was conducted on prospectively collected data from the French Medical Information System Database (PMSI). All patients undergoing STC in France were included. The association between definitive stoma and potential risk factors was studied using univariate and multivariate analyses.

Results: A total of 1860 patients were included (age 45 ± 9 years; median follow-up 30 months). Of these, 77% (n = 1442) presented with ulcerative colitis. Mortality and morbidity at 90 days after STC were 5% (n = 100) and 47% (n = 868), respectively. Reconstructive surgery was identified in 1255 patients (67%) at a mean interval of 7 months from STC. Seveny-four per cent (n = 932) underwent a completion proctectomy with ileal pouch anal anastomosis and 26% (n = 323) an ileorectal anastomosis. Six hundred and five (33%) patients with a definitive stoma had an abdominoperineal resection (n = 114; 19%) or did not have any further surgical procedure (n = 491; 81%). Independent risk factors for definitive stoma identified in multivariate analysis were older age, Crohn's disease, colorectal neoplasia, postoperative complication after STC, laparotomy and a low-volume hospital.

Conclusion: We found that 33% of patients undergoing STC with ileostomy for IBD had definitive stoma. Modifiable risk factors for definitive stoma were laparotomy and a low-volume hospital.

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KEYWORDS
Crohn's disease, definitive stoma, ulcerative colitis

INTRODUCTION

Management of inflammatory bowel disease (IBD) is multidisciplinary with an increasing role for immunosuppressive treatments. Nonetheless a substantial proportion of patients still require surgery. Indeed, about 70% of Crohn's disease (CD) patients [1] and 15% of patients with ulcerative colitis (UC) will need surgery [2].

Subtotal colectomy (STC) with ileostomy is recommended as the safest option in cases of acute colitis refractory to medical treatment or complicated by perforation, toxic megacolon or severe haemorrhage [3]. In the elective setting, in the event of refractory disease or malignancy, STC may be preferred as the first step in surgical treatment for high-risk patients presenting with severe disease, high doses of immunosuppressive treatment or poor nutritional status [4], or in cases of indeterminate colitis, as the pathological examination can change the initial clinical diagnosis of IBD [5]. STC is a quick and easy procedure with a low morbidity and mortality rate [6], and it is technically feasible to perform it laparoscopically. The absence of an anastomosis avoids the threat of leakage in a typically high-risk population and preserves the option of a future return to intestinal continuity.

After STC, completion proctectomy with ileal pouch–anal anastomosis (IPAA) is the restorative procedure of choice for UC and for selected patients with pancolonic CD [3, 7, 8]. It entails the removal of all colonic and diseased rectal mucosa and restores bowel continuity, avoiding a definitive stoma. An improved quality of life and a high level of satisfaction are reported with IPAA surgery [9, 10]. It can be realized as a two-stage (completion proctectomy and IPAA with no defunctioning ileostomy) or a three-stage procedure (with a loop ileostomy) [11]. An ongoing trial comparing modified two-stage and three-stage procedures is currently recruiting participants [12]. Ileorectal anastomosis (IRA) can be offered to highly selected patients as an alternative to IPAA [13, 14].

However, although proctocolectomy with IPAA is the recommended treatment, a significant number of patients do not undergo subsequent surgery after STC. Therefore, these patients are fated to live with a definitive stoma while their rectal remnant is still in place. While small single-centre retrospective studies describe rather low rates, between 10% [14] and 30% [15–17], of patients having a definitive stoma, two recent national cohort studies in Sweden and England revealed that up to 65% and 70% of patients, respectively, had a definitive stoma after STC with ileostomy for IBD [18, 19]. In a multicentre study, Aquina et al. reported a similarly low rate of only 32% of patients proceeding to an IPAA [20].

The aim of this study was to assess the rate of definitive stoma and reconstructive surgery after STC in a large national population-based cohort and identify the risk factors associated with definitive stoma to take stock of the current practices in France and to understand the discrepancies reported in the literature.

What does this paper add to the literature?

Rates of definitive stoma after subtotal colectomy for inflammatory bowel disease are around 60%–70%. In this observational population-based study of 1860 patients, we showed that 67% of patients underwent secondary reconstructive surgery, mainly with ileal pouch–anal anastomosis, and only 33% had a definitive stoma. We identified age, Crohn's disease, neoplasia, laparotomy, postoperative complications and a low-volume hospital as risk factors for definitive stoma.

METHOD

Study design and population

We conducted a retrospective observational cohort study using the French national registry database Programme de Médicalisation des Systèmes d'Information (PMSI). The PMSI routinely collects and gathers standardized administrative and medical information concerning every medical structure (public and private) in France. Public health care services are equally available to the entire French population. Data about demographic characteristics, principal and associated discharge diagnosis codes (based on the International Classification of Diseases 10th edition, ICD-10), medical procedure codes (based on the French national Classification Commune des Actes Médicaux, 11th edition), discharge date, length of stay and hospital identifiers are available for each inpatient admitted. The validity of this prospective coding system has been tested by cross-referencing it with other cohort databases as previously described [21–25]. Access to the data was approved and authorized by the Commission Nationale de l'Informatique et des Libertés (CNIL).

All patients undergoing STC between 2013 and 2021 were identified with the codes HHFA021 for open and HHFA005 for laparoscopic procedures. Patients were included if the surgery was performed for UC or CD, identified with the codes K50 and K51. Patients younger than 15 years at the time of STC were excluded from the analysis.

Primary endpoint

The primary endpoint was secondary reconstructive surgery with either IPAA or IRA. Patients undergoing IPAA surgery after STC as a two-stage procedure (completion proctectomy and IPAA with no defunctioning ileostomy) were identified with the codes HJFA012 and HHFA031 for open procedures and HJFC023 and HHFA028 for laparoscopic procedures. Patients having a three-stage procedure (with a defunctioning ileostomy) were identified with the combination of IPAA and stoma closure. Stoma closure was identified with codes HGSA001, HGFA007, HGFC021, HGMA005, HHMA003 and HHMC001 and reconstructions by IRA were identified with the following codes: HGSA001, HGFA007, HGFC021, HGMA005, HHMA003, HHMC001, HHFA022 and HHFA004 without IPAA. The interval from STC to reconstructive surgery was recorded. Patients undergoing an abdominoperineal resection with definitive stoma were identified with the codes HHFA03, HHFA029, HJFA005, HJFA007, HJFA014 or HJFA019 without any codes for stoma closure. All codes are summarized in Appendix S1.

Covariate exposures

The following data were extracted and collected from the database: patient-related variables [age, gender, type of IBD, comorbidities, smoking, nutritional status (malnutrition, obesity), social characteristics], perioperative variables (emergency surgery, colorectal neoplasia, time between admission and surgery, surgical procedures, postoperative outcomes, length of stay) and institution-related variables (hospital type, annual caseload). The Charlson Comorbidity Index (CCI) score (0–37) and French index of social deprivation (FDep) score (increasing with the importance of social deprivation) were calculated for each patient (Appendices S2 and S3). Hospital annual volume was calculated regarding the activity of colorectal surgery as follows: number of colectomies for cancer performed per year per hospital during the study period. Hospital volumes were categorized according to the number of colectomies for cancer as low-volume (<50 colectomies/year), medium-volume (50–150 colectomies/year) or high-volume hospitals (>150 colectomies/year).

Statistical analysis

Categorical variables are presented as percentages and compared using a chi-square test or Fisher's exact test. Continuous variables are expressed as means and standard deviations if normally distributed or median and interquartile range if not and analysed by means of Student's *t*-test or the Mann–Whitney *U*-test. An analysis of risk factors for postoperative 90-day mortality after STC was performed with logistic regression.

The cumulative incidence of secondary reconstructive surgery was estimated using Kaplan–Meier survival analysis. The log-rank test was used to calculate *p*-values. Univariate and multivariate analyses were performed to calculate hazard ratios using Cox regression modelling, integrating the following potential cofounders for adjusted estimates: age, gender, CCI, obesity, malnutrition, IBD type, FDep, smoking, primary sclerosing cholangitis, emergency surgery, colorectal neoplasia, postoperative morbidity after STC, hospital volume, laparoscopy, year of surgery. A subgroup analysis was performed on UC patients.

Statistical significance was considered as $p<0.05$. R software was used to perform all analyses [26]. Data are reported following STROBE and RECORD recommendations [27, 28].

RESULTS

Population characteristics

A total of 1860 patients undergoing a STC for IBD between 2013 and 2021 were included. Demographic and perioperative data are reported in Table 1. The mean age was 45.5 ± 18.9 years at the time of STC. The number of male patients was 1040 (56%). Median follow-up was 30 months (range 10–61 months) after STC. UC was the most frequent disease, and affected 1442 patients (77%), whereas 418 patients (23%) presented with CD. A total of 1261 (68%) patients were malnourished. Three hundred and twenty-one STC procedures

TABLE 1 Demographic and perioperative data for 1860 patients with inflammatory bowel disease who underwent subtotal colectomy (STC).

		Ulcerative colitis (*n* = 1442, 77%)	**Crohn's disease (*n* = 418, 23%)**
Age (years) at the time of STC	45.5 ± 18.9	45.5 ± 19	45.6 ± 18.6
Male	1040 (56%)	851 (59%)	189 (45%)
Charlson Comorbidity Index score	0.6 ± 1.4	0.6 ± 1.5	0.5 ± 1.3
Obesity	140 (7%)	107 (7%)	33 (8%)
Malnutrition	1261 (68%)	984 (68%)	277 (66%)
FDep	0 ± 1.4	−0.1 ± 1.4	0.1 ± 1.5
Smoking	135 (7%)	81 (6%)	54 (13%)
Primary sclerosing cholangitis	40 (2%)	29 (2%)	11 (3%)
Emergency surgery	321 (17%)	243 (17%)	78 (19%)
Colorectal neoplasia	68 (4%)	44 (3%)	24 (6%)
Time from admission to surgery			
<2 days	680 (37%)	503 (35%)	177 (42%)
2–7 days	523 (28%)	429 (30%)	94 (23%)
>7 days	657 (35%)	510 (35%)	147 (35%)
Laparoscopic approach	1344 (72%)	1113 (77%)	231 (55%)
Hospital volume			
High (>150/year)	1286 (69%)	1010 (70%)	276 (66%)
Medium (50–150/year)	448 (24%)	350 (24%)	98 (23%)
Low (<50/year)	126 (7%)	82 (6%)	44 (10%)

Note: Continuous variables are given as mean ± standard deviation. FDep indicates French index of social deprivation. Hospital volume is given in the number of colectomies for cancer per year.

(17%) were performed as an emergency and 68 (4%) for neoplasia; 657 (35%) STCs were performed more than 7 days after the date of admission. The majority of STCs (72%) were performed via a laparoscopic approach. Sixty-nine per cent of patients were operated on in high-volume hospitals, 24% in medium-volume hospitals and 7% in low-volume hospitals.

Risk factors associated with 90-day mortality after STC

There were 100 (5%) 90-day postoperative deaths after STC and 868 (47%) of 1860 patients experienced postoperative complications, with the majority represented by intra-abdominal and wound abscesses (31%), followed by respiratory complications (12%), acute kidney failure (11%) and thromboembolic events (9%). The median length of stay was 18 days.

On univariate analysis (Table 2) we observed that older age, greater CCI score, CD (33% vs. 22%; $p=0.010$), obesity (13% vs. 7%; $p=0.036$), smoking (15% vs. 7%; $p=0.003$) and colorectal neoplasia (9% vs. 3%; $p=0.005$) were associated with a higher risk of postoperative mortality after STC. In addition, a lower use of laparoscopy (19% vs. 75%; $p<0.001$), and a higher frequency of STC performed in low-volume (23% vs. 6%; $p<0.001$) and medium-volume hospitals (38% vs. 23%; $p<0.001$) were associated with postoperative mortality. We did not observe any significant association between postoperative mortality and interval to surgery after admission nor of patient interhospital transfer.

On multivariate analysis (Table 2), age above 65 years [OR = 8.25 (2.36–52.28); $p=0.005$], CCI score higher than 1 (1–2, $p=0.017$; 3–4, $p=0.001$; >4, $p=0.003$), laparotomy [OR = 7.14 (4.20–12.50); $p<0.001$] and low- [OR = 3.31 (1.67–6.50); $p=0.001$] and medium-volume hospitals [OR = 1.73 (1.01–2.97); $p=0.045$] were independent risk factors associated with postoperative mortality. Malnutrition was associated with a lower risk of death at 90 days [OR = 0.33 (0.20–0.53); $p<0.001$].

Primary outcome: reconstruction surgery

After a median duration of 7 months [5–15], secondary reconstruction surgery was performed in 1255 (67%) of the 1860 patients (Figure 1). A completion proctectomy with IPAA was performed in 932 (50%) of these and 323 (17%) underwent IRA. Among patients with an IPAA, 138 (15%) had a two-stage procedure (i.e. without a defunctioning ileostomy). Six hundred and five (33%) patients had a definitive stoma and 114 (19%) of these had an abdominoperineal resection after STC, suggesting that their disease did not allow restoration of bowel continuity, whereas the majority (81%) had a definitive stoma because they did not undergo subsequent surgery after STC. The crude rate of secondary restorative surgery was 56%, 66% and 67% at 1, 3 and 5 years, respectively. Figure 2 shows the probability of reconstructive surgery over time after STC. The cumulative incidence at 1 year was 0.63 (95% CI 0.61–0.65), at 3 years 0.77 (95% CI 0.74–0.79) and at 5 years 0.79 (95% CI 0.77–0.81).

Risk factors associated with definitive stoma

Figure 3 shows the probability of reconstructive surgery according to hospital volume and surgical approach. In multivariate Cox regression analysis (Table 3), older age [hazard ratio (HR) 1.01 (1.01–1.02); $p<0.001$], colorectal neoplasia [HR 1.73 (1.22–2.46); $p=0.002$], postoperative morbidity [HR 1.22 (1.02–1.46); $p=0.033$] and low-volume hospital [HR 1.41 (1.05–1.89); $p=0.021$] were independent risk factors for definitive stoma. Laparoscopy and UC were associated with a lower HR for definitive stoma [HR 0.71 (0.58–0.85), $p<0.001$; HR 0.82 (0.68–0.98), $p=0.033$ respectively].

Subgroup analysis of patients with UC

A complementary multivariate analysis restricted to patients who had a STC for UC (Appendix S4) identified the following independent risk factors associated with definitive stoma: age [HR 1.02 (1.01–1.02); $p<0.001$], CCI score higher than 4 [HR 2.01 (1.26–3.20); $p=0.004$], postoperative morbidity [HR 1.61 (1.30–2.00); $p<0.001$] and low- [HR 1.43 (1.10–1.86); $p=0.007$] and medium-volume hospitals [HR 1.38 (1.06–1.82); $p=0.019$]. Laparoscopy was significantly associated with a lower risk of definitive stoma [HR 0.62 (0.49–0.79); $p<0.001$].

DISCUSSION

This observational population-based study reports the outcome following STC for IBD over a median follow-up of 30 months in a large national cohort. We showed that 67% of patients underwent secondary reconstructive surgery with a mean interval after STC of 7 months. Proctectomy with IPAA was the most common surgical procedure (74%), while 26% had an IRA. Among patients with definitive stoma (33%), 19% had an abdominoperineal resection whereas the majority (81%) did not undergo any further surgical procedure after STC. We identified older age, CD, colorectal neoplasia, postoperative complications after STC and low-volume hospital as risk factors for definitive stoma. STC performed by laparoscopy was significantly associated with a lower risk of definitive stoma.

We observed a 90-day postoperative mortality rate of 5% and a morbidity rate of 47% after STC. These unexpectedly high rates contrast with previous studies from specialized hospitals which describe a mortality rate under 2% [6, 29]. This notable difference can be explained by the pragmatic nature of our study, reflecting real-life practice, and are distinguished from the experience of tertiary specialized centres alone. This important morbidity and mortality after STC reflect the fragility of IBD patients at the time surgical intervention

TABLE 2 Univariate and multivariate analysis of 90-day postoperative mortality in 1860 patients who underwent subtotal colectomy (STC) for inflammatory bowel disease.

	90-day mortality		Univariate analysis		Multivariate analysis	
	Yes (*n* = 100)	No (*n* = 1760)	Odds ratio (95% CI)	*p*-value	Adjusted odds ratio (95% CI)	*p*-value
Age (years) at the time of STC						
15–24	2 (1%)	297 (17%)	1		1	
25–44	11 (11%)	629 (36%)	2.60 (0.69–16.85)	0.216	1.63 (0.42–10.83)	0.534
45–64	26 (26%)	528 (30%)	7.31 (2.17–45.59)	0.007	2.82 (0.78–18.10)	0.174
≥65	61 (61%)	306 (17%)	29.60 (9.15–181.51)	<0.001	8.25 (2.36–52.28)	0.005
Sex						
Male	55 (55%)	985 (56%)	1		1	
Female	45 (45%)	775 (44%)	1.04 (0.69–1.56)	0.850	1.10 (0.68–1.77)	0.708
Charlson Comorbidity Index score						
0	46 (46%)	1381 (78%)	1		1	
1–2	29 (29%)	282 (16%)	3.09 (1.89–4.97)	<0.001	1.99 (1.12–3.48)	0.017
3–4	14 (14%)	58 (3%)	7.25 (3.66–13.64)	<0.001	4.02 (1.78–8.73)	0.001
>4	11 (11%)	39 (2%)	8.47 (3.92–17.12)	<0.001	3.95 (1.57–9.43)	0.003
Obesity						
No	87 (87%)	1633 (93%)	1		1	
Yes	13 (13%)	127 (7%)	1.92 (1.00–3.42)	0.036	0.86 (0.39–1.76)	0.682
Malnutrition						
No	53 (53%)	546 (31%)	1		1	
Yes	47 (47%)	1214 (69%)	0.40 (0.27–0.60)	<0.001	0.33 (0.20–0.53)	<0.001
FDep mean (SD)	−0.2 (1.6)	−0.0 (1.4)	0.95 (0.83–1.09)	0.428	0.83 (0.71–0.98)	0.023
Smoking						
No	85 (85%)	1640 (93%)	1		1	
Yes	15 (15%)	120 (7%)	2.41 (1.30–4.19)	0.003	1.79 (0.87–3.51)	0.100
STC for neoplasia						
No	91 (91%)	1701 (97%)	1		1	
Yes	9 (9%)	59 (3%)	2.85 (1.29–5.66)	0.005	0.93 (0.38–2.11)	0.868
Delay of surgery after admission						
<2 days	36 (36%)	644 (37%)	1		1	
2–7 days	24 (24%)	499 (28%)	0.86 (0.50–1.45)	0.578	0.91 (0.48–1.68)	0.760
>7 days	40 (40%)	617 (35%)	1.16 (0.73–1.85)	0.531	1.57 (0.90–2.76)	0.112
IBD type						
Crohn's disease	33 (33%)	385 (22%)	1		1	
Ulcerative colitis	67 (67%)	1375 (78%)	0.57 (0.37–0.88)	0.010	0.84 (0.50–1.42)	0.504
Surgical approach						
Laparotomy	81 (81%)	435 (25%)	1		1	
Laparoscopy	19 (19%)	1325 (75%)	0.08 (0.04–0.13)	<0.001	0.14 (0.08–0.24)	<0.001
Hospital volume						
High (>150/year)	39 (39%)	1247 (71%)	1		1	
Medium (50–150/year)	38 (38%)	410 (23%)	2.96 (1.87–4.70)	<0.001	1.73 (1.01–2.97)	0.045
Low (<50/year)	23 (23%)	103 (6%)	7.14 (4.06–12.33)	<0.001	3.31 (1.67–6.50)	0.001
Interhospital transfer						
No	78 (78%)	1479 (84%)	1		1	
Yes	22 (22%)	281 (16%)	1.48 (0.89–2.38)	0.114	1.56 (0.83–2.83)	0.154

Note: FDep indicates French index of social deprivation. Odds ratios indicate relative likelihood for definitive stoma and were adjusted for all variables included. Hospital volume is given in the number of colectomies for cancer per year.

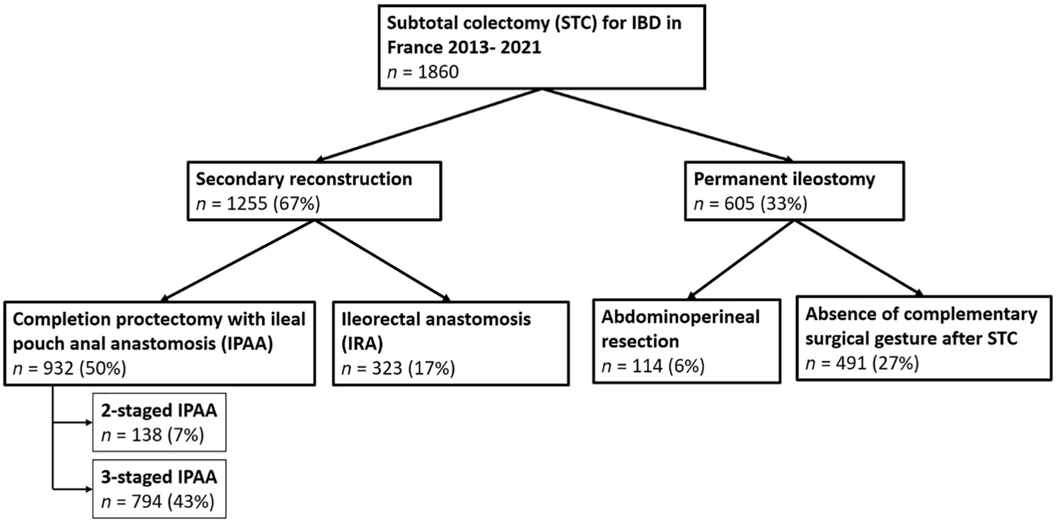

FIGURE 1 Flow-chart representing the outcome following 1860 subtotal colectomies for inflammatory bowel disease (IBD) over a median follow-up of 30 months.

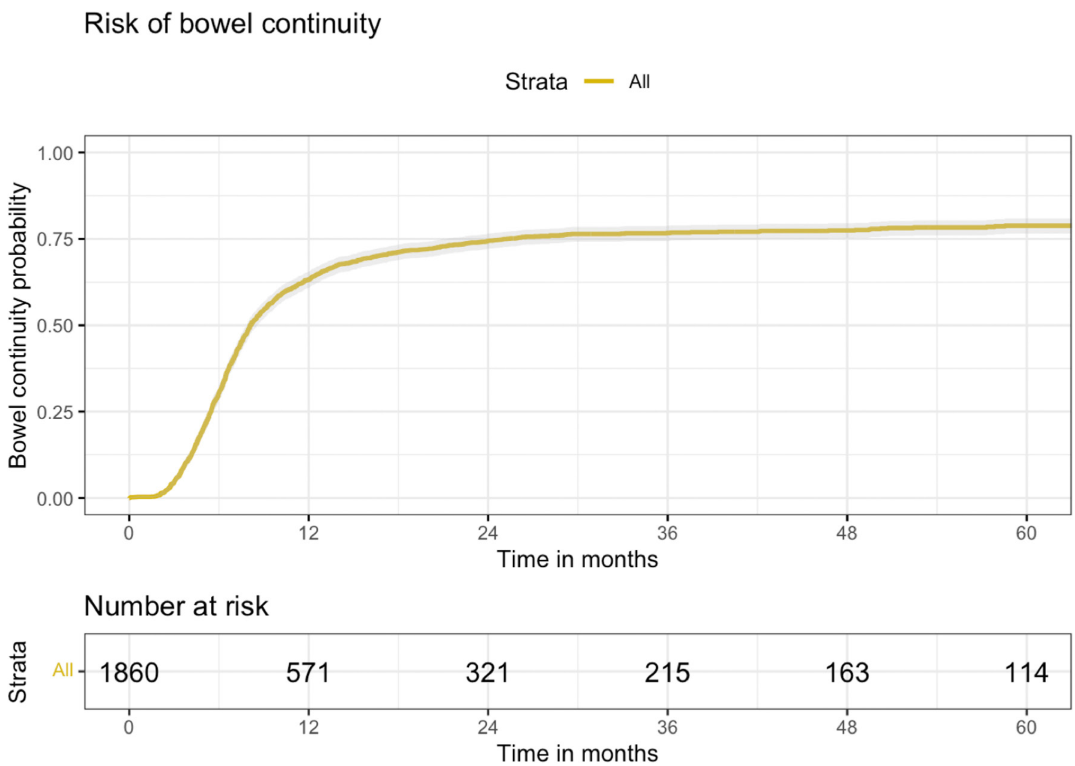

FIGURE 2 Cumulative incidence curve representing time to reconstructive surgery after subtotal colectomy in 1860 patients with inflammatory bowel disease.

is required. Indeed, in our cohort more than two-thirds of patients were malnourished and 17% of STCs were performed in an emergency setting. Moreover, we determined that age above 65 years and comorbidities were independent risk factors for postoperative mortality. Interestingly, we observed that 35% of STCs were performed more than 7 days after admission, suggesting a long duration of medical therapy before choosing surgical treatment in cases of acute or emergent colitis: it is known that delayed surgery is associated with increased postoperative complications [30].

A laparoscopic approach seems to play an important role in decreasing postoperative mortality and likely morbidity. Faster return of bowel function, lower risk of wound infection and intra-abdominal abscess and shorter length of stay are among the benefits of laparoscopic STC reported in the literature [31, 32]. We observed a significant difference in 90-day postoperative mortality between open and laparoscopic approaches (16% vs. 1%). However, these results must be considered with caution, as mortality could also be related to the severity of the underlying condition that explained the choice of open

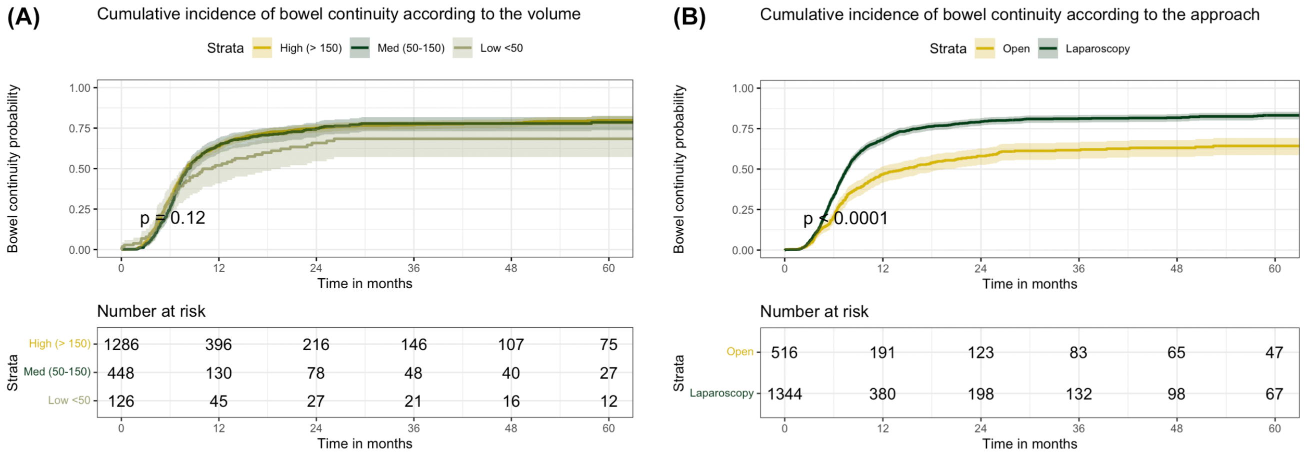

FIGURE 3 (A) Kaplan–Meier curves stratified by hospital volume of colectomies for cancer per year (low <50; medium 50–150; high >150), representing time to reconstructive surgery after subtotal colectomy in 1860 patients with inflammatory bowel disease. (B) Kaplan–Meier curves stratified by surgical approach (laparoscopy or laparotomy), representing time to reconstructive surgery after subtotal colectomy in 1860 patients with inflammatory bowel disease.

surgery (colonic perforation or important comorbidities contraindicating laparoscopy, for example). Nevertheless, the majority of STCs (72%) were performed via a laparoscopic approach and laparoscopy remained associated with lower odds of mortality after adjustment.

We found that medium- and low-volume hospitals were independent risk factors for postoperative mortality. Kaplan et al. also reported an inverse correlation between postoperative morbidity and mortality after STC and annual hospital volume [33]. Hospital volume can influence postoperative outcomes by gathering multidisciplinary management with experienced clinicians and trained surgeons providing intense medical therapy but timely surgery, improved patient selection and high-quality perioperative care. Thus, referring patients for STC, when possible, to more specialized hospitals should be considered.

We chose to focus on the rate of secondary reconstruction after STC, and thus did not include patients undergoing primary reconstructive surgery (IPAA or IRA at the same time of colectomy) in order to elucidate why some patients do not proceed to this recommended secondary procedure and have a definitive stoma. In this study, we observed a large proportion of patients accessing secondary reconstructive surgery (67%), distinct from reports in recent national studies. Nordenvall et al. [18] and Worley et al. [19] stated that only 34% and 20% of patients had secondary restorative surgery in Sweden and England, respectively, while Aquina et al. [20] reported a low rate of 32% of patients being offered a secondary IPAA in a multicentre study conducted in New York State. A higher rate ranging from 66% to 86% is observed in small single-centre retrospective studies carried out in in specialized hospitals [15–17]. This variable access to secondary reconstructive surgery can be partly explained by two modifiable risk factors: hospital volume and laparoscopic approach.

We observed that low hospital volume was independently associated with the risk of definitive stoma, as has been previously noted in the Swedish cohort and in the Aquina et al. multicentre study [18, 20]. In our cohort, 69% of patients were operated on in high-volume hospitals. Comparatively, in Sweden only 27% underwent STC in high-volume hospitals and 65% of the procedures described in the Aquina et al. multicentre study were performed in low-volume hospitals. IPAA is a technically demanding surgery requiring experience in colorectal surgery. An inverse correlation between IPAA surgical experience and postoperative morbidity is reported, and it is observed that low institutional volume is associated with higher risk of IPAA failure and reintervention [34–38]. Moreover, laparoscopic expertise is required for IPAA surgery as it provides better short-term postoperative outcomes and a limited impact on fertility compared with open surgery in this relatively young population [22, 39–42]. Considering these arguments, patients should be referred to high-volume hospitals for STC, and where this is not feasible they should be referred after STC for secondary reconstruction. Our study reinforces the need for centralization of IBD surgery to improve patient care and suggests a need for national or international directives to defined expert centres.

We observed that a laparoscopic approach for STC was associated with a higher probability of undergoing reconstructive surgery. Furthermore, patients who undergo laparoscopic STC progress more rapidly to completion proctectomy with IPAA, and adhesiolysis is performed less often and less extensively when compared with open STC [32, 41]. Thus, the laparoscopic approach appears to have a significant impact on short-term postoperative outcomes that may lead to faster recovery and a higher probability of achieving a secondary restorative surgery, that may be performed earlier. In our study, 72% of patients had a laparoscopic STC whereas this accounted for less than 2% of Swedish patients, which could partly explain the gap between reconstruction rates. It should be noted that the Nordenvall et al. study [18] was carried out before our study, and that surgery and surgical techniques have evolved between these periods.

Discrepancies in surgical management of IBD between European countries can be described. While only 26% of patients undergoing restorative surgery had an IRA in our cohort, higher rates were observed in Sweden, where it is the preferred reconstruction procedure (54%) [18]. IRA can be considered as a reasonable alternative for selected patients, with fewer postoperative complications.

TABLE 3 Multivariate analysis of risk factors for definitive stoma in 1860 patients who underwent subtotal colectomy (STC) for inflammatory bowel disease (IBD).

	Definitive stoma ($n = 605$)	Reconstructive surgery ($n = 1255$)	Adjusted hazard ratio (95% CI)	*p*-value
Age (years) at the time of STC	55.0 ± 20.5	40.9 ± 16.2	1.01 (1.01–1.02)	<0.001
Sex				
Female	276 (46%)	544 (43%)	1	
Male	329 (54%)	711 (57%)	1.09 (0.92–1.29)	0.334
Charlson Comorbidity Index score				
0	380 (62.8)	1047 (83.4)	1	
1–2	150 (24.8)	161 (12.8)	0.93 (0.75–1.15)	0.496
3–4	42 (6.9)	30 (2.4)	1.11 (0.79–1.56)	0.562
>4	33 (5.5)	17 (1.4)	1.44 (0.99–2.10)	0.057
Obesity				
No	535 (88%)	1185 (94%)	1	
Yes	70 (12%)	70 (6%)	0.92 (0.71–1.19)	0.525
Malnutrition				
No	202 (33%)	397 (32%)	1	
Yes	403 (67%)	858 (68%)	0.92 (0.77–1.09)	0.331
FDep mean (SD)	0 (1.4)	−0.1 (1.4)	0.98 (0.93–1.04)	0.549
Smoking				
No	548 (91%)	1177 (94%)	1	
Yes	57 (9%)	78 (6%)	1.08 (0.81–1.44)	0.589
Primary sclerosing cholangitis				
No	590 (98%)	1230 (98%)	1	
Yes	15 (2%)	25 (2%)	0.78 (0.45–1.38)	0.399
Emergent STC				
No	480 (79%)	1059 (84%)	1	
Yes	125 (21%)	196 (16%)	1.18 (0.95–1.46)	0.131
STC for neoplasia				
No	566 (94%)	1226 (98%)	1	
Yes	39 (6%)	29 (2%)	1.73 (1.22–2.46)	0.002
IBD type				
Crohn's disease	211 (35%)	207 (16%)	1	
Ulcerative colitis	394 (65%)	1048 (84%)	0.82 (0.68–0.98)	0.033
Postoperative morbidity				
No	236 (39%)	756 (60)	1	
Yes	369 (61%)	499 (40)	1.22 (1.02–1.46)	0.033
Surgical approach				
Laparotomy	282 (47%)	234 (19%)	1	
Laparoscopy	323 (53%)	1021 (81%)	0.71 (0.58–0.85)	<0.001
Hospital volume				
High (>150/year)	390 (65%)	896 (71%)	1	
Medium (50–150/year)	153 (25%)	295 (24%)	0.92 (0.76–1.13)	0.435
Low (<50/year)	62 (10%)	64 (5%)	1.41 (1.05–1.89)	0.021

Note: Hazard ratios were adjusted for all variables included. FDep indicates French index of social deprivation. Hospital volume is given in the number of colectomies for cancer per year.

However, it is associated with a higher long-term failure rate than IPAA, related to the poorer functional results and neoplasia of the rectum that require regular endoscopic monitoring [14, 43, 44]. For these reasons IRA is not the restorative procedure of choice among French surgeons. The high rates of definitive stoma in English and Swedish series compared with France could also be explained by better stoma acceptance in northern populations, which is illustrated by the relatively high rate of abdominoperineal resections in the management of rectal cancer in these countries [45]. However, studies depict satisfactory functional outcomes and quality of life with IPAA, and an improvement in sexuality, work and social function when compared with a definitive stoma, which should encourage IPAA surgery if possible [9, 10, 46].

Even where IPAA is the recommended surgical treatment, some patients are unsuitable for surgery to restore bowel continuity. Firstly, we identified several risk factors for definitive stoma related to the frailty of these patients (older age, colorectal neoplasia and postoperative morbidity after STC) that could explain the absence of reconstructive surgery, in conjunction with poor physical condition and/or reduced anal function. Secondly, patients with CD were more likely to have a definitive stoma, potentially due to the impossibility of performing restorative surgery in the presence of severe perianal or small bowel disease, and the higher risk of IPAA failure [47]. In a subgroup analysis restricted to patients with UC, the association between patient frailty, hospital volume and surgical approach and the risk of definitive stoma remained evident.

In our cohort, 19% of patients with a definitive stoma required an abdominoperineal resection, suggesting that their disease did not permit the restoration of bowel continuity. Unexpectedly, however, most patients (81%) had a definitive stoma related to the absence of a subsequent surgery after STC. This rate raises questions about patient management after STC. Some patients might not be offered reconstructive surgery because they have no medical follow-up or because they are not referred onwards to surgeons to complete the surgery. Some might be ineligible or not keen for reconstruction and thus do not proceed to completion proctectomy, leaving them at risk of developing persisting symptoms or neoplasia [48–50]. Regular endoscopic monitoring of the retained rectum is necessary, but fewer than half of patients are reported to be compliant [9]. In long-term studies, 7% to 25% of patients with the rectum in place after STC will require completion proctectomy as a consequence of persistent symptoms or neoplasia [51, 52]. Even where reconstructive surgery is unlikely, patients should proceed to completion proctectomy, especially when the indication for STC was colorectal neoplasia.

The major strengths of this analytic study are its large size, its long length of follow-up and its population-based nature allowing the inclusion of 1860 patients with limitation of selection bias and reflecting real life practice. This national cohort based on systematic routinely collected data provides accurate information about current practice in France. Nevertheless, several limitations are inherent to the study. This registry study is dependent on the quality of coding, as incorrect or missing data may lead to selection or misclassification bias. Coding of surgical procedures is expected to be accurate since it is realized with remuneration purposes for surgeons. We also chose to study postoperative mortality as it is an objective and robust outcome. Our study is limited by the lack of clinical or histological data, such as disease activity, disease duration before surgery or immunosuppressive medical therapies, that could influence postoperative outcomes. Moreover, technical surgical details such as management of the rectal remnant (rectal stump closed intra-abdominally or double-end ileo-sigmoidostomy) are not available and could have an impact on restorative surgery. Indeed, double-end ileo-sigmoidostomy seems to be associated with a lower rate of conversion [52].

CONCLUSION

In this large national population-based study, 67% of patients undergoing STC with ileostomy for IBD subsequently underwent reconstructive surgery. This rate is higher than previously reported in other population-based studies, but a substantial proportion of patients remain with definitive stoma due to the absence of a further surgical procedure after STC (81%). Definitive stoma is associated with older age, Crohn's disease, colorectal neoplasia, postoperative morbidity, laparotomy and low-volume hospital. Patients should be referred to specialized high-volume hospitals for STC and secondary reconstruction.

AUTHOR CONTRIBUTIONS

Jeremie H. Lefèvre: Conceptualization; writing – original draft; writing – review and editing; supervision; project administration. **Julie Deyrat:** Data curation; writing – original draft; writing – review and editing. **Alexandre Challine:** Conceptualization; data curation; formal analysis; writing – original draft; writing – review and editing. **Thibault Voron:** Visualization; writing – review and editing. **Lauren V. O'Connell:** Writing – review and editing. **Maxime K. Collard:** Writing – review and editing; data curation. **Stylianos Tzedakis:** Data curation; writing – review and editing. **Romain Jaquet:** Data curation; writing – review and editing. **Andrea Lazzati:** Data curation; writing – review and editing. **Yann Parc:** Project administration; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

No conflict of interest to report.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

None.

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REFERENCES

1. Cosnes J, Gower-Rousseau C, Seksik P, Cortot A. Epidemiology and natural history of inflammatory bowel diseases. Gastroenterology. 2011;140(6):1785–94. https://doi.org/10.1053/j.gastro.2011.01.055
2. Fumery M, Singh S, Dulai PS, Gower-Rousseau C, Peyrin-Biroulet L, Sandborn WJ. Natural history of adult ulcerative colitis in population-based cohorts: a systematic review. Clin Gastroenterol Hepatol. 2018;16(3):343–56.E3. https://doi.org/10.1016/j.cgh.2017.06.016
3. Oresland T, Bemelman WA, Sampietro GM, Spinelli A, Windsor A, Ferrante M, et al. European evidence based consensus on surgery for ulcerative colitis. J Crohns Colitis. 2015;9(1):4–25. https://doi.org/10.1016/j.crohns.2014.08.012
4. Mege D, Figueiredo MN, Manceau G, Maggiori L, Bouhnik Y, Panis Y. Three-stage laparoscopic Ileal pouch-anal anastomosis is the best approach for high-risk patients with inflammatory bowel disease: an analysis of 185 consecutive patients. J Crohns Colitis. 2016;10(8):898–904. https://doi.org/10.1093/ecco-jcc/jjw040
5. Hermand H, Lefevre JH, Shields C, Chafai N, Debove C, Beaugerie L, et al. Postoperative diagnostic revision for Crohn disease after subtotal colectomy for inflammatory bowel disease. Int J Colorectal Dis. 2021;36(4):709–15. https://doi.org/10.1007/s00384-020-03783-9
6. Lawday S, Leaning M, Flannery O, Summers S, Antoniou GA, Goodhand J, et al. Rectal stump management in inflammatory bowel disease: a cohort study, systematic review and proportional analysis of perioperative complications. Tech Coloproctol. 2020;24(7):671–84. https://doi.org/10.1007/s10151-020-02188-8
7. Adamina M, Bonovas S, Raine T, Spinelli A, Warusavitarne J, Armuzzi A, et al. ECCO guidelines on therapeutics in Crohn's disease: surgical treatment. J Crohns Colitis. 2020;14(2):155–68. https://doi.org/10.1093/ecco-jcc/jjz187
8. Melton GB, Fazio VW, Kiran RP, He J, Lavery IC, Shen B, et al. Long-term outcomes with ileal pouch-anal anastomosis and Crohn's disease: pouch retention and implications of delayed diagnosis. Ann Surg. 2008;248(4):608–16. https://doi.org/10.1097/SLA.0b013e318187ed64
9. Fazio VW, Kiran RP, Remzi FH, Coffey JC, Heneghan HM, Kirat HT, et al. Ileal pouch anal anastomosis: analysis of outcome and quality of life in 3707 patients. Ann Surg. 2013;257(4):679–85. https://doi.org/10.1097/SLA.0b013e31827d99a2
10. Heikens JT, de Vries J, van Laarhoven CJ. Quality of life, health-related quality of life and health status in patients having restorative proctocolectomy with ileal pouch-anal anastomosis for ulcerative colitis: a systematic review. Colorectal Dis. 2012;14(5):536–44. https://doi.org/10.1111/j.1463-1318.2010.02538.x
11. Hor T, Zalinski S, Lefevre JH, Shields C, Attal E, Tiret E, et al. Feasibility of laparoscopic restorative proctocolectomy without diverting stoma. Dig Liver Dis. 2012;44(2):118–22. https://doi.org/10.1016/j.dld.2011.09.007
12. Beyer-Berjot L, Baumstarck K, Loubiere S, Vicaut E, Berdah SV, Benoist S, et al. Is diverting loop ileostomy necessary for completion proctectomy with ileal pouch-anal anastomosis? A multicenter randomized trial of the GETAID Chirurgie group (IDEAL trial): rationale and design (NCT03872271). BMC Surg. 2019;19(1):192. https://doi.org/10.1186/s12893-019-0657-7
13. Duclos J, Lefevre JH, Lefrancois M, Lupinacci R, Shields C, Chafai N, et al. Immediate outcome, long-term function and quality of life after extended colectomy with ileorectal or ileosigmoid anastomosis. Colorectal Dis. 2014;16(8):O288–O296. https://doi.org/10.1111/codi.12558
14. Uzzan M, Cosnes J, Amiot A, Gornet JM, Seksik P, Cotte E, et al. Long-term follow-up after Ileorectal anastomosis for ulcerative colitis: a GETAID/GETAID Chirurgie multicenter retrospective cohort of 343 patients. Ann Surg. 2017;266(6):1029–34. https://doi.org/10.1097/SLA.0000000000002022
15. Munie S, Hyman N, Osler T. Fate of the rectal stump after subtotal colectomy for ulcerative colitis in the era of ileal pouch-anal anastomosis. JAMA Surg. 2013;148(5):408–11. https://doi.org/10.1001/jamasurg.2013.177
16. Brady RR, Collie MH, Ho GT, Bartolo DC, Wilson RG, Dunlop MG. Outcomes of the rectal remnant following colectomy for ulcerative colitis. Colorectal Dis. 2008;10(2):144–50. https://doi.org/10.1111/j.1463-1318.2007.01224.x
17. Bohm G, O'Dwyer ST. The fate of the rectal stump after subtotal colectomy for ulcerative colitis. Int J Colorectal Dis. 2007;22(3):277–82. https://doi.org/10.1007/s00384-006-0127-4
18. Nordenvall C, Myrelid P, Ekbom A, Bottai M, Smedby KE, Olén O, et al. Probability, rate and timing of reconstructive surgery following colectomy for inflammatory bowel disease in Sweden: a population-based cohort study. Colorectal Dis. 2015;17(10):882–90. https://doi.org/10.1111/codi.12978
19. Worley G, Nordenvall C, Askari A, Pinkney T, Burns E, Akbar A, et al. Restorative surgery after colectomy for ulcerative colitis in England and Sweden: observations from a comparison of nationwide cohorts. Colorectal Dis. 2018;20(9):804–12. https://doi.org/10.1111/codi.14113
20. Aquina CT, Fleming FJ, Becerra AZ, Hensley BJ, Noyes K, Monson JRT, et al. Who gets a pouch after colectomy in New York state and why? Surgery. 2018;163(2):305–10. https://doi.org/10.1016/j.surg.2017.07.024
21. Pierron A, Revert M, Goueslard K, Vuagnat A, Cottenet J, Benzenine E, et al. Evaluation of the metrological quality of the medico-administrative data for perinatal indicators: a pilot study in 3 university hospitals [Evaluation de la qualite metrologique des donnees du programme de medicalisation du systeme d'information (PMSI) en perinatalite: etude pilote realisee dans 3 CHU]. Rev Epidemiol Sante Publique. 2015;63(4):237–46. https://doi.org/10.1016/j.respe.2015.05.001
22. Challine A, Voron T, O'Connell L, Chafai N, Debove C, Collard MK, et al. Does an Ileo-anal anastomosis decrease the rate of successful pregnancy compared to an Ileorectal anastomosis? A National Study of 1,491 patients. Ann Surg. 2023;277(5):806–12. https://doi.org/10.1097/SLA.0000000000005569
23. Challine A, Kirouani M, Markar SR, Tzedakis S, Jaquet R, Piessen G, et al. MIRO study: do the results of a randomized controlled trial apply in a real population? Surgery. 2024;175(4):1055–62. https://doi.org/10.1016/j.surg.2023.11.026
24. Boudemaghe T, Belhadj I. Data resource profile: the French National Uniform Hospital Discharge Data set Database (PMSI). Int J Epidemiol. 2017;46(2):392. https://doi.org/10.1093/ije/dyw359
25. Uhry Z, Remontet L, Grosclaude P, Velten M, Colonna M. Estimating the incidence of colorectal cancer in France from a hospital discharge database, 1999–2003 [Estimations departementales de l'incidence du cancer colorectal en France a partir des donnees hospitalieres, 1999–2003]. Rev Epidemiol Sante Publique. 2009;57(5):329–36. https://doi.org/10.1016/j.respe.2009.05.004
26. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2005. http://www.R-project.org
27. Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, et al. The REporting of studies conducted using observational routinely-collected health data (RECORD) statement. PLoS Med. 2015;12(10):e1001885. https://doi.org/10.1371/journal.pmed.1001885
28. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. Int J Surg. 2014;12(12):1495–9. https://doi.org/10.1016/j.ijsu.2014.07.013
29. Alves A, Panis Y, Bouhnik Y, Maylin V, Lavergne-Slove A, Valleur P. Subtotal colectomy for severe acute colitis: a 20-year experience of

a tertiary care center with an aggressive and early surgical policy. J Am Coll Surg. 2003;197(3):379–85. https://doi.org/10.1016/S1072-7515(03)00434-4
30. Randall J, Singh B, Warren BF, Travis SP, Mortensen NJ, George BD. Delayed surgery for acute severe colitis is associated with increased risk of postoperative complications. Br J Surg. 2010;97(3):404–9. https://doi.org/10.1002/bjs.6874
31. Bartels SA, Gardenbroek TJ, Ubbink DT, Buskens CJ, Tanis PJ, Bemelman WA. Systematic review and meta-analysis of laparoscopic versus open colectomy with end ileostomy for non-toxic colitis. Br J Surg. 2013;100(6):726–33. https://doi.org/10.1002/bjs.9061
32. Chung TP, Fleshman JW, Birnbaum EH, Hunt SR, Dietz DW, Read TE, et al. Laparoscopic vs. open total abdominal colectomy for severe colitis: impact on recovery and subsequent completion restorative proctectomy. Dis Colon Rectum. 2009;52(1):4–10. https://doi.org/10.1007/DCR.0b013e3181975701
33. Kaplan GG, McCarthy EP, Ayanian JZ, Korzenik J, Hodin R, Sands BE. Impact of hospital volume on postoperative morbidity and mortality following a colectomy for ulcerative colitis. Gastroenterology. 2008;134(3):680–7. https://doi.org/10.1053/j.gastro.2008.01.004
34. Hicks CW, Hodin RA, Bordeianou L. Possible overuse of 3-stage procedures for active ulcerative colitis. JAMA Surg. 2013;148(7):658–64. https://doi.org/10.1001/2013.jamasurg.325
35. de Zeeuw S, Ahmed Ali U, Donders RA, Hueting WE, Keus F, van Laarhoven CJ. Update of complications and functional outcome of the ileo-pouch anal anastomosis: overview of evidence and meta-analysis of 96 observational studies. Int J Colorectal Dis. 2012;27(7):843–53. https://doi.org/10.1007/s00384-011-1402-6
36. Burns EM, Bottle A, Aylin P, Clark SK, Tekkis PP, Darzi A, et al. Volume analysis of outcome following restorative proctocolectomy. Br J Surg. 2011;98(3):408–17. https://doi.org/10.1002/bjs.7312
37. Kennedy ED, Rothwell DM, Cohen Z, McLeod RS. Increased experience and surgical technique lead to improved outcome after ileal pouch-anal anastomosis: a population-based study. Dis Colon Rectum. 2006;49(7):958–65. https://doi.org/10.1007/s10350-006-0521-6
38. Parc Y, Reboul-Marty J, Lefevre JH, Shields C, Chafai N, Tiret E. Restorative proctocolectomy and Ileal pouch-anal anastomosis. Ann Surg. 2015;262(5):849–54. https://doi.org/10.1097/SLA.0000000000001406
39. Larson DW, Cima RR, Dozois EJ, Davies M, Piotrowicz K, Barnes SA, et al. Safety, feasibility, and short-term outcomes of laparoscopic ileal-pouch-anal anastomosis: a single institutional case-matched experience. Ann Surg. 2006;243(5):667–70; discussion 670–2. https://doi.org/10.1097/01.sla.0000216762.83407.d2
40. Fleming FJ, Francone TD, Kim MJ, Gunzler D, Messing S, Monson JR. A laparoscopic approach does reduce short-term complications in patients undergoing ileal pouch-anal anastomosis. Dis Colon Rectum. 2011;54(2):176–82. https://doi.org/10.1007/DCR.0b013e3181fb4232
41. Bartels SA, D'Hoore A, Cuesta MA, Bensdorp AJ, Lucas C, Bemelman WA. Significantly increased pregnancy rates after laparoscopic restorative proctocolectomy: a cross-sectional study. Ann Surg. 2012;256(6):1045–8. https://doi.org/10.1097/SLA.0b013e318250caa9
42. Beyer-Berjot L, Maggiori L, Birnbaum D, Lefevre JH, Berdah S, Panis Y. A total laparoscopic approach reduces the infertility rate after ileal pouch-anal anastomosis: a 2-center study. Ann Surg. 2013;258(2):275–82. https://doi.org/10.1097/SLA.0b013e3182813741
43. Andersson P, Norblad R, Soderholm JD, Myrelid P. Ileorectal anastomosis in comparison with ileal pouch anal anastomosis in reconstructive surgery for ulcerative colitis–a single institution experience. J Crohns Colitis. 2014;8(7):582–9. https://doi.org/10.1016/j.crohns.2013.11.014
44. Uzzan M, Kirchgesner J, Oubaya N, Amiot A, Gornet JM, Seksik P, et al. Risk of rectal neoplasia after colectomy and ileorectal anastomosis for ulcerative colitis. J Crohns Colitis. 2017;11(8):930–5. https://doi.org/10.1093/ecco-jcc/jjx027
45. Bahadoer RR, Dijkstra EA, van Etten B, Marijnen CAM, Putter H, Kranenbarg EMK, et al. Short-course radiotherapy followed by chemotherapy before total mesorectal excision (TME) versus preoperative chemoradiotherapy, TME, and optional adjuvant chemotherapy in locally advanced rectal cancer (RAPIDO): a randomised, open-label, phase 3 trial. Lancet Oncol. 2021;22(1):29–42. https://doi.org/10.1016/S1470-2045(20)30555-6
46. Kuruvilla K, Osler T, Hyman NH. A comparison of the quality of life of ulcerative colitis patients after IPAA vs. ileostomy. Dis Colon Rectum. 2012;55(11):1131–7. https://doi.org/10.1097/DCR.0b013e3182690870
47. Lightner AL, Jia X, Zaghiyan K, Fleshner PR. IPAA in known preoperative Crohn's disease: a systematic review. Dis Colon Rectum. 2021;64(3):355–64. https://doi.org/10.1097/DCR.0000000000001918
48. Dal Buono A, Carvello M, Sachar DB, Spinelli A, Danese S, Roda G. Diversion proctocolitis and the problem of the forgotten rectum in inflammatory bowel diseases: a systematic review. United Eur Gastroenterol J. 2021;9(10):1157–67. https://doi.org/10.1002/ueg2.12175
49. Derikx L, Nissen LHC, Smits LJT, Shen B, Hoentjen F. Risk of neoplasia after colectomy in patients with inflammatory bowel disease: a systematic review and meta-analysis. Clin Gastroenterol Hepatol. 2016;14(6):798–806.E20. https://doi.org/10.1016/j.cgh.2015.08.042
50. Abdalla M, Landerholm K, Andersson P, Andersson RE, Myrelid P. Risk of rectal cancer after colectomy for patients with ulcerative colitis: a National Cohort Study. Clin Gastroenterol Hepatol. 2017;15(7):1055–1060.E2. https://doi.org/10.1016/j.cgh.2016.11.036
51. Ten Hove JR, Bogaerts JMK, Bak MTJ, Laclé MM, Meij V, Derikx LAAP, et al. Malignant and nonmalignant complications of the rectal stump in patients with inflammatory bowel disease. Inflamm Bowel Dis. 2019;25(2):377–84. https://doi.org/10.1093/ibd/izy253
52. Mege D, Stellingwerf ME, Germain A, Colombo F, Pellino G, di Candido F, et al. Management of rectal stump during laparoscopic subtotal colectomy for inflammatory bowel disease: a comparative cohort study from six referral centres. J Crohns Colitis. 2020;14(9):1214–21. https://doi.org/10.1093/ecco-jcc/jjaa046

SUPPORTING INFORMATION

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