



Original Article

Segmental Colectomy for Ulcerative Colitis: Is There a Place in Selected Patients Without Active Colitis? An International Multicentric Retrospective Study in 72 Patients

A. Frontali,^a L. Cohen,^b V. Bridoux,^c P. Myrelid,^{d,e} G. Sica,^e Gilberto Poggioli,^f E. Espin,^g L. Beyer-Berjot,^h D. Laharie,ⁱ A. Spinelli,^{j,k} P. Zerbib,^l G. Sampietro,^{m,o} M. Frasson,^{n,o} E. Louis,^o S. Danese,^{k,p} M. Fumery,^q Q. Denost,^r R. Altwegg,^s S. Nancey,^t F. Michelassi,^u X. Treton,^b Y. Panis^{a,o}

^aDepartment of Colorectal Surgery, Beaujon Hospital, Assistance Publique-Hôpitaux de Paris, Clichy and Université de Paris, France ^bDepartment of Gastroenterology, Beaujon Hospital, Assistance Publique-Hôpitaux de Paris, Université Paris VII, Clichy, France ^cCHU Rouen, Digestive Surgery, Rouen, France ^dDepartment of Biomedical and Clinical Sciences, Linköping University and Department of Surgery, Linköping University Hospital, Linköping Sweden ^ePoliclinico Tor Vergata, Digestive Surgery, Roma, Italy ^fPoliclinico Sant'OrsolaMalpighi, Digestive Surgery, Bologna, Italy ^gHospital Universitari Val d'Hebron, Digestive Surgery, Barcelona, Spain ^hHopital Nord, Digestive Surgery, Marseille, France ⁱDepartment of Gastroenterology, CHU Bordeaux, Bordeaux, France ^jDepartment of Colorectal Surgery, Humanitas Clinical and Research Center – IRCCS, via Manzoni 56, 20089 Rozzano, Milan, Italy ^kDepartment of Biomedical Sciences, Humanitas University, via Rita Levi Montalcini 4, 20090, Pieve Emanuele, Milan, Italy ^lCHU Lille, Digestive Surgery, Lille, France ^mDepartment of Surgery, IBD Unit, Luigi Sacco University Hospital, Milano, Italy ⁿUniversity Hospital La Fe, Digestive Surgery, Valencia, Spain ^oCHU Liege, Gastroenterology, Liege, France ^pIBD center, Department of Gastroenterology, Humanitas Clinical and Research Center – IRCCS, via Manzoni 56, 20089 Rozzano, Milan, Italy ^qDepartment of Gastroenterology, CHU Amiens Picardie, Amiens, France ^rDepartment of Colorectal Surgery, CHU Bordeaux, Bordeaux, France ^sDepartment of Gastroenterology, CHU Montpellier, Montpellier, France ^tDepartment of Gastroenterology, CHU Lyon, Lyon, France ^uDepartment of Surgery, New York Presbyterian Hospital Weill Cornell Medical Centre, New York, NY, USA

Corresponding author: Yves Panis, MD, PhD, Département de Chirurgie Colorectale, Hôpital Beaujon, 100 Boulevard du Général Leclerc, 92110 Clichy, France. Tel.: 00 33 1 40 87 45 47; fax: 00 33 1 40 87 44 31; email: yves.panis@aphp.fr

Abstract

Background and Aims: The aim of this study was to report a multicentric experience of segmental colectomy [SC] in ulcerative colitis [UC] patients without active colitis, in order to assess if SC can or cannot represent an alternative to ileal pouch-anal anastomosis [IPAA].

Methods: All UC patients undergoing SC were included. Postoperative complications according to ClavienDindo's classification, long term results, and risk factors for postoperative colitis and reoperation for colitis on the remnant colon, were assessed.

Results: A total of 72 UC patients underwent: sigmoidectomy [$n = 28$], right colectomy [$n = 24$], proctectomy [$n = 11$], or left colectomy [$n = 9$] for colonic cancer [$n = 27$], 'diverticulitis' [$n = 17$], colonic stenosis [$n = 5$], dysplasia or polyps [$n = 8$], and miscellaneous [$n = 15$]. Three patients died postoperatively and 5/69 patients [7%] developed early flare of UC within 3 months after SC. After a median followup of 40 months, 24/69 patients [35%] were reoperated after a median

delay after SC of 19 months [range, 2–158 months]: 22/24 [92%] underwent total colectomy and ileorectal anastomosis [$n = 9$] or total colectomy [TCP] [$n = 13$] and 2/24 [8%] an additional SC. Reasons for reoperation were: colitis [$n = 14$; 20%], cancer [$n = 3$] or dysplasia [$n = 3$], colonic stenosis [$n = 1$], and unknown reasons [$n = 3$]. Endoscopic score of colitis before SC was Mayo 23 in 5/5 [100%] patients with early flare vs 15/42 without early flare [36%; $p = 0.0101$] and in 9/12 [75%] patients with reoperation for colitis vs 11/35 without reoperation [31%; $p = 0.016$].

Conclusions: After segmental colectomy in UC patients, postoperative early colitis is rare [7%]. Segmental colectomy could possibly represent an alternative to IPAA in selected UC patients without active colitis.

Key Words: Segmental colectomy; ulcerative colitis; postoperative flare

1. Introduction

Ulcerative colitis [UC] is a chronic inflammatory condition that causes continuous mucosal inflammation, which affects the rectum and to a variable extent the colon.¹ The current incidence of UC in Europe is estimated at from 0.9 to 24.3 per 100 000 person-years.² The prevalence of UC in Europe is estimated at 2.1 million persons.² Restorative total colectomy [TCP] with ileal pouch-anal anastomosis [IPAA], recommended since early 80s, offers in the majority of patients a complete removal of the diseased or potentially diseased mucosa, an effective prevention and treatment of colorectal cancer, and an unchanged body image with no stoma and a preserved anal route of defaecation. For this reason, IPAA is today the gold standard for UC patients needing surgery.³ It concerns approximately 15% to 20% of UC patients, mainly because of refractory acute colitis, dysplasia or cancer, or long-standing refractory disease with severe symptoms and poor quality of life.¹

The only alternative to TCP and IPAA is represented today by total colectomy [TC] with ileorectal anastomosis [IRA]. In the latest 2015 ECCO guidelines on surgery for UC,⁴ it is stated that: ‘under optimal circumstances, IRA is a reasonable alternative to IPAA. Outcome advantages are such as lower morbidity and preserved female fecundity need to be weighed against the need for rectal surveillance and subsequent proctectomy in 50% of the cases’ [level of evidence 3] [Statement 5I]. Even if some inflammatory bowel disease [IBD] surgeon considers that there is no place for IRA in surgical UC patients, on the other hand for some others, including our group, IRA can be proposed in selected UC patients [approximately 10% to 15% of UC patients undergoing surgery]⁵ especially when indication for colonic surgery is not related to UC complications. ECCO Statement 3F suggested also that in case of dysplasia/cancer, the recommended operation is TCP with IPAA.⁴

Until now, SC [or proctectomy only] is never suggested in UC patients. The two main reasons are: first, the theoretical risk of postoperative colitis in the remnant colon; and second, the well-known risk of development of dysplasia or even cancer elsewhere in the colon after SC. Thus, segmental colectomy has no place today for the surgical treatment of UC.

However, sometimes surgery can be discussed for UC in aged patients, with localised cancer or dysplasia, or for colonic stenosis. In these situations, subtotal colectomy with IRA [or even IPAA] are performed. However, in aged patients or patients with comorbidity, risks of bad function after IPAA and of severe postoperative morbidity lead some surgeons to propose SC in highly selected UC patients.

To our knowledge, there are very few data published on SC in UC. A recent paper⁶ coming from the US veterans health care system has reported encouraging results of SC in UC patients with colorectal cancer. However only 25 cases were reported, making analysis of the results very difficult. Another US study⁷ has evaluated,

in patients with either Crohn’s disease [CD] or UC, evolution after SC for colitis-associated neoplasia. Seventeen patients were included, and all patients had quiescent disease in the remnant colon, but in this study only six patients with UC were included.

Thus, the aim of our study was to report a large multicentric experience of SC for UC in patients without active colitis, operated for reasons other than colitis, coming from inflammatory bowel disease expert centres over the world, in order to assess: [a] the postoperative and long-term risk of such strategy in UC patients; and [b] if SC could represent an alternative to IRA or IPAA in selected UC patients.

2. Methods

2.1. Study population

This was a retrospective multicentric study from expert IBD centres from Europe and the USA. All consecutive patients with a diagnosis of UC who underwent SC or isolated proctectomy without associated colectomy, whatever the indication, as the first colorectal resection have been registered in a dedicated database. Patients with a diagnosis of Crohn’s disease or undetermined colitis were excluded, as well as patients who underwent TC or TCP as first operation.

2.2. Outcomes measures

Preoperative colitis was assessed on preoperative colonoscopy [i.e. performed during the last 6 months before SC] according to Mayo score.^{8,9} We evaluated preoperative patients’ characteristics including age, sex, UC duration and extension, preoperative treatments, indication for surgery, and co-morbidities. UC activity before surgery was assessed by an endoscopic evaluation of UC performed no more than 6 months before surgery. We chose to assess the activity of UC using exclusively the Mayo endoscopic subscore, as this consensual scoring item was available in all the medical charts of the participating centres. The Mayo score was defined as follows¹⁰:

1. Mayo 0: normal mucosa or inactive disease;
2. Mayo 1: mild activity [erythema, decreased vascular pattern, mild friability];
3. Mayo 2: moderate activity [marked erythema, lack of vascular pattern, friability, erosions];
4. Mayo 3: severe activity [spontaneous bleeding, large ulcerations].

Postoperative complications according to ClavienDindo’s classification and longterm results [recurrent colitis, reoperation] were studied. Risk factors for early postoperative colitis and reoperation

for colitis on the remnant colon were also assessed by univariate analysis.

Early postoperative colitis after SC was defined as a flare of UC less than 3 months after SC, based on clinical and endoscopic evaluation documented by the referent physician in the medical chart. Late colitis was defined by a flare of UC more than 3 months after SC.

2.3. Statistical analysis

Qualitative data were reported as number of patients [percentage of patients] and were compared with either the Pearson χ^2 test or the Fisher exact test, as appropriate. All tests were two-sided, with a level of significance set at $p < 0.05$.

This study was approved by our institutional review board and conducted according to the ethical standards of the Committee on Human Experimentation of our institution and reported according to the Strengthening the Reporting of Observational Studies in Epidemiology [STROBE] guidelines.¹¹

3. Results

3.1. Patients' characteristics

A total of 72 patients undergoing SC were included in this study. Patients came from 17 expert IBD centres. There were 50 men [70%] and 22 women, with a mean age at diagnosis of UC of 46 ± 18 years [range, 11–86] and mean age at SC of 57 ± 17 years [range, 14–84]. The mean age at surgery for the 22 women was 59.8 years [median age, 65 years] [range 24–83].

Indications for surgery were: colonic cancer [$n = 27$], sigmoid 'diverticulitis' [$n = 17$], colonic stenosis [$n = 5$], colonic dysplasia or polyps [$n = 8$], and others reasons [$n = 15$]: two for endoscopic perforation, two for haemorrhage, two for suspicion of Crohn's disease, two for colonic perforation [and one refused other surgery than segmental resection], one as part of a trial on segmental colectomy, one for volvulus, and for the last two the indication for surgery was unknown but in one of the two a mucinous appendicular neoplasm [low-grade] was discovered on pathological examination, in absence of active UC. Among the 72 patients, four [5.5%] were operated as emergencies for endoscopic perforation [$n = 2$] and bleeding [$n = 2$]. All the other patients were operated electively. Patients' and UC characteristics are detailed in [Table 1](#).

Before SC, 22 [31%] patients were not under medical treatment, 28 [39%] patients were treated with 5-aminosalicylate [5ASA], four [5.5%] with 5ASA and steroids, five [7%] with steroids only, three [4%] with azathioprine, four [5.5%] with anti-tumour necrosis factor [TNF], 3]three [4%] with other treatments, and for three [4%] patients their medical treatment before surgery was unknown. The 72 patients underwent: sigmoidectomy [$n = 28$, 39 %], right colectomy [$n = 24$, 33%], proctectomy [$n = 11$, 15 %], or left colectomy [$n = 9$, 13%].

3.2. Postoperative results

Mean hospital stay was 10.9 ± 7.8 [range 1–31] days. Postoperative complications [at <30 days] were observed in 17/72 patients [24%]: ClavienDindo III in seven [10%] and III or more in 10 [14%]. A Clavien-Dindo III postoperative complication was noted in 6/72 patients [8%] and a Clavien-Dindo IV in one [1%] patient. Three patients died postoperatively [4%] due to respiratory [$n = 2$] or hepatic [$n = 1$] failure.

3.3. Postoperative and long-term colitis and reoperation

Although no patient presented early postoperative [during the first 30 days after SC] severe acute colitis, 5/69 patients [7%] developed

early flare of UC within the 3 months after SC: 2two were treated initially medically but one of them required completion TC, 15 months after SC. The three others patients presented refractory colitis [after a median of 1 month after SC] requiring either completion SC [$n = 1$], completion TC [$n = 1$], or TCP with definitive end ileostomy [$n = 1$] [after a median of 1 month after SC, range 1 4 months].

During follow-up, 29 patients among the 64 other patients [45%] developed late flare of UC [more than 3 months after SC] after a median delay of 26 months [range, 3–480 months]. Among them, 12/29 [41%] underwent surgery [one SC, threeTC, and eight TCP] after a median delay of 40 months after SC [range, 4–158 months].

At the end of follow-up, 35/69 patients [51%] did not present recurrent flare of colitis since SC: among them, 30 did not presented any symptoms, five presented mild clinical disease activity, and 25/35 were under medical treatment.

After a median follow -p after SC of 40 months [range 1–600 months], 24/69 patients [35%] were reoperated after a median delay after SC of 19 months [range 2–158 months]: 22/24 [92%] underwent TC [$n = 9$] or TCP [$n = 13$] and 2/24 [8%] an additional SC. Indications for reoperation were: refractory colitis [$n = 14$; 20%], colonic cancer [$n = 3$] or dysplasia [$n = 3$], colonic stenosis [$n = 1$], and unknown reasons [$n = 3$].

3.4. Risk factors for early flare and reoperation for colitis

Among the 69 patients surviving after SC, five patients [7%] presented early flare of UC [before 3 months after SC]: 0/5 patients with Mayo endoscopic subscore of 0 or 1 at colonoscopy before surgery [0%] versus 5/5 [100%] in patients with Mayo endoscopic subscore of 2 or 3 [$p = 0.01$] [[Table 2](#)]. Neither sex, age at diagnosis of UC or at SC, extension of colitis, nor clinical disease activity before SC were associated with an increased risk of early flare after SC. Temporary stoma was significantly associated with a higher risk of early flare after segmental colectomy: 4/5 [80%] of patients with early flare after SC had a temporary stoma vs 13/64 [20%] of patients without early flare of UC [$p = 0.0116$]. However, it suggested probably only that patients with temporary stoma have more inflammation [as also demonstrated by preoperative endoscopy with more scoring Mayo 2–3, which is also significantly associated with early flare after SC], making surgery more difficult and leading the surgeon to create a temporary stoma.

In all, 29 [42%] presented late flare: 9/29 patients [31%] with Mayo endoscopic subscore of 0 or 1 before surgery versus 6/29 [21%] with Mayo endoscopic subscore of 2 or 3 [Mayo subscore missing in 14/29 patients] [$p =$ not significant, NS].

Subsequently 14/69 patients [20%] were reoperated for refractory colitis on the remnant colon: 3/12 [25%] patients presented a Mayo endoscopic subscore of 0 or 1 at colonoscopy before surgery versus 9/12 [75%] with Mayo endoscopic subscore of 2 or 3 [for two patients, Mayo endoscopic subscore was missing] [$p = 0.0391$] [[Table 3](#)]. Comparing these patients with patients not reoperated for colitis [$n = 55$], the Mayo endoscopic subscore was 2 or 3 in 9/12 [75%] patients with reoperation for colitis versus 11/35 without roperation [31%; $p = 0.0161$].

4. Discussion

Our study showed that after SC for UC, made for other reason than active colitis, the risk of early [within the first 30 days] postoperative severe or acute colitis is nil. Furthermore, only 7% of the patients presented early flare during the first 3 months after surgery and

Table 1. Clinical, endoscopic, and surgical findings of 72 patients undergoing segmental colectomy for ulcerative colitis.

Number of patients	n = 72
Sex	
Men	50 [70%]
Women	22 [30%]
Mean age	
At diagnosis	46 ± 18 [range, 11–86]
At segmental colectomy	57 ± 17 [range, 14–84]
Extension of colitis before surgery	
Montreal E0	0 [0%]
Montreal E1	12 [17%]
Montreal E2	31 [43%]
Montreal E3	15 [21%]
Unknown	14 [19%]
Clinical disease activity before surgery	
No activity [remission]	6 [8%]
Mild	30 [42%]
Moderate	16 [22%]
Severe	4 [5.5%]
Acute colitis	4 [5.5%]
Unknown	12 [17%]
Endoscopic disease activity before surgery	
Mayo 0	7 [10%]
Mayo 1	21 [29%]
Mayo 2	14 [19%]
Mayo 3	7 [10%]
Unknown [or colonoscopy more than 6 months before surgery]	23 [32%]
Therapy before surgery	
No treatment	22 [31%]
5ASA	28 [39%]
Steroids	5 [7%]
5ASA + steroids	4 [5.5%]
Anti-TNF	4 [5.5%]
Azathioprine	3 [4%]
Other	3 [4%]
Unknown	3 [4%]
Type of segmental colectomy	
Sigmoidectomy	28 [39 %]
Right colectomy	24 [33%]
Proctectomy	11 [15%]
Left colectomy	9 [13%]
Indications for segmental colectomy	
Colonic cancer	27 [37%]
Localised colitis	17 [24%]
Colonic stenosis	5 [7%]
Dysplasia or polyps	8 [11%]
Others	15 [21%]
Stoma during segmental colectomy	
Yes	20 [28%]
No	52 [72%]

5-ASA, 5-aminosalicylate; TNF, tumour necrosis factor.

none presented a severe or acute colitis. Thus, the risk of severe postoperative colitis in the remnant colon is more theoretical than real, and cannot be used as an argument against segmental colectomy in selected UC patients. At the end of follow-up, although 45% of the patients were treated for flare of colitis on the remnant colon and 35% were reoperated [mainly for colitis], the majority of patients avoid completion colectomy or proctectomy during follow up.

Today, for approximately 12% to 20% of UC patients requiring surgery, whatever the indication [acute colitis, dysplasia or

Table 2. Risk factors for early postoperative flare of colitis in 69 patients undergoing segmental colectomy for ulcerative colitis.

	Early flare n = 5	No early flare n = 64	p
Sex			NS
Men	4	44	
Women	1	20	
Mean age			NS
At diagnosis of UC	37 ± 10	47 ± 19	
At segmental colectomy	48 ± 15	58 ± 20	
Extension of colitis before surgery			NS
Montreal E0-E1	0	11	
Montreal E2-E3	5	39	
Unknown	0	14	
Clinical disease activity before surgery			NS
No activity [remission] or moderate	4	45	
Severe or acute colitis	1	7	
Unknown	0	12	
Endoscopic disease activity before surgery			0.0101
Mayo 0–1	0	27	
Mayo 2–3	5	15	
Unknown	0	23	
Type of surgery			NS
Right colectomy	1	23	NS
Left colectomy	1	8	
Sigmoidectomy	2	24	
Proctectomy	1	9	
Right colectomy	1	23	
Left colectomy + sigmoidectomy	2	32	
Temporary stoma at SC			0.0116
Yes	4	13	
No	1	51	

SC, segmental colectomy; NS, not significant.

cancer, or refractory long-standing colitis], the current guidelines and the majority of IBD surgeons recommend proposing a total colectomy with IPAA [either in a two-step, modified two-step, or three-step operation].^{12,13} IPAA cures the disease, prevents or cures colorectal cancer, preserves anal function, and gives a good or acceptable quality of life in the majority of patients.^{14,15} Furthermore, since the introduction of laparoscopy, postoperative morbidity is reduced and fertility is maintained in young females.¹⁶ For all these reasons, there is no real alternative today to laparoscopic IPAA for UC patients. IRA can be proposed in highly selected patients, but for most of the centres it must be reserved for patients without dysplasia or cancer, primary sclerosing cholangitis, refractory proctitis, or long history of UC, all well-known risk factors for development of rectal cancer after IRA.⁵

However in UC, surgery is not only required in young and fit patients. Sometimes surgery is indicated for colonic or rectal cancer, colonic stenosis, or other reasons in relatively aged patients [over 60 or even 70], without any symptoms of UC but with a previous history of UC treated medically. In these situations, following the current guidelines, IPAA must be theoretically proposed because of the very high risk of cancer and dysplasia in the remnant colon.⁴ Even IRA is contraindicated in case of cancer of the colon. In either IPAA and IRA, the risk of postoperative morbidity or even mortality is increased by the age of the patient. Furthermore, poor function after IPAA, or even after IRA in case of proctitis, is sometimes observed

Table 3. Risk factors for reoperation for refractory colitis in 69 patients undergoing segmental colectomy for ulcerative colitis.

	Reoperation <i>n</i> = 14	Not reoperated <i>n</i> = 55	<i>p</i>
Sex			NS
Men	10	38	
Women	4	17	
Mean age			NS
At diagnosis of UC	48 ± 21	47 ± 17	
At segmental colectomy	57 ± 21	57 ± 17	
Extension of colitis before surgery			NS
Montreal E0E1	12	32	
Montreal E2E3	0	13	
Unknown			
Clinical disease activity before surgery			NS
No activity [remission] or moderate	9	39	
Severe or acute colitis	4	74	
Unknown	1	12	
Endoscopic disease activity before surgery			0.016
Mayo 0–1	3	24	
Mayo 2–3	9	11	
Unknown	2	20	

NS, not significant.[][]

in some aged patients after such surgery and alters severely their quality of life.

These observations lead some surgeons to go outside the guidelines and propose in highly selected UC patients an SC instead of IPAA or IRA in aged patients with localised colonic cancer or indications unrelated to active ulcerative colitis. Even if probably many surgeons have already made this choice in a few patients, to the best of our knowledge there are only few papers published on this topic. In the first one, Lindberg *et al.*¹⁷ reported only four cases of SC for colorectal cancer complicating UC and among them only one died 6 months later. In the second paper,⁶ data of patients were extracted from the Nationwide Veterans Affairs Healthcare System in the USA. Although retrospective and coming from a national database with all the bias existing in this kind of analysis, the authors were able to find among 1087 patients with colorectal cancer complicating UC, 59 patients undergoing segmental colectomy [*n* = 25] or total colectomy [*n* = 34], with information available for preoperative colonoscopy, surgical specimens, and follow-up. In the segmental colectomy group, the median age of the patients was 73 years, with a diagnosis of UC made at median 62 years. The comorbidity Charlson Index was 3+ in 72% of these patients, confirming, if necessary, that in UC some aged patients with comorbidity required surgery relatively late. Despite the small number of patients in this retrospective study, some interesting data can be found. First, and not surprisingly, more than 80% of these patients required some medical therapy during follow-up after surgery [versus only 20% in the 35 patients undergoing total colectomy]. This is very interesting, and an argument for a possible role of SC in UC patients is that after a follow-up of 9 years, only one patient [4%] after SC required reoperation [completion total colectomy], and no patient developed metachronous colorectal cancer in the remnant colon. Only one patient after SC developed liver metastases [4%] during follow-up. Unfortunately, it was impossible to make any analysis

of possible risk factors for postoperative colitis and reoperation in these patients, in order to better select patients for SC.

Anyway, this study also suggested that SC seems to be an attractive option in some aged UC patients with colorectal cancer. In case of segmental colectomy performed for either dysplasia or cancer, a careful follow-up with chromoendoscopy 1 year after segmental colectomy must probably be proposed. Furthermore, in case of cancer in the specimen of segmental colectomy, follow-up with computed tomography [CT] and Carcino-Embryonic Antigen [CEA] serum level must be the rule [for example, every 3 months during the first 2 years and then every 6 months up to 5 years after surgery]. Because segmental colectomy is to date not recommended in UC patients, and because these patients need a strict follow-up of the remnant colon, probably these patients must be referred and treated only in expert IBD centres.

In order to have more evidence on the possible role of SC in the surgical armamentarium in UC patients, we conducted a large multicentric study worldwide and ask many expert IBD centres to send the records of UC patients undergoing SC whatever the indication. We were able to get 72 patients, which is the largest series to date on this subject, but which confirms also that even among 17 IBD centres, SC still has a very little place in the surgical management of UC patients. We confirmed in our study what was observed in the Khan *et al.* study⁶ concerning the very low risk of postoperative colitis after SC: only 7% presented moderate or mild postoperative colitis and none a severe or acute episode. Because of a larger number of patients we were also able to analyse possible risk factors for early flare after SC: only endoscopic activity of the colitis before surgery, with Mayo score 2 or 3, was associated with a significantly higher rate of postoperative colitis.

Same risk factors were observed for postoperative reoperation for colitis after segmental colectomy, suggesting a role of colonic inflammation in the postoperative course after SC. We observed that 35% of our patients need reoperation during follow-up. What we know already, because it was previously published,¹⁸ is that reoperation and transformation of ileorectal anastomosis to ileal pouch-anal anastomosis is feasible and safe, without increased morbidity. Thus, we can expect that it will be quite the same for transformation of SC to TC and IRA or even to TCP and IPAA. Thus, if SC is performed as a first operation, reoperation will probably be not associated with an increased morbidity rate. But SC can also become an advantage in terms of fertility in young females, especially if performed by laparoscopy. Previous studies have already demonstrated that fertility is not reduced after subtotal colectomy; thus it will probably be the same after SC. Furthermore, we previously observed that a laparoscopic approach does not reduce fertility in comparison with an open approach.^{16,19} Thus, starting surgical history in selected UC patients by SC does not expose the patient to a high risk of morbidity if reoperation is needed, and also preserves probably better fertility in young females than does primary IPAA.

In conclusion, our study, even if retrospective with all the possible bias associated with such kinds of study, suggested that segmental colectomy is contraindicated in patients with active colitis at the time of SC. For all the other patients, SC will have probably some place in the surgical management of UC. However, in patients with endoscopic remission of UC, especially aged patients with comorbidity, relatively limited life expectancy, localised colonic cancer, and a relatively short history of UC before diagnosis of cancer, SC could possibly be discussed as an alternative to either IRA or IPAA.

Funding

The authors have no funding to declare.

Conflict of Interest

None.

Author Contributions

AF, LC, XT, and YP: [1] the concept and design of the study, or acquisition of data, or analysis and interpretation of data, [2] drafting the article or revising it critically for important intellectual content, [3] final approval of the version to be submitted. VB, PM, GS, GP, EE, LB-B, DL, AS, PZ, GS, MF, EL, SD, MF, QD, RA, SN, FM: [1] the acquisition of data, [2] revising the article critically for important intellectual content, [3] final approval of the version to be submitted.

Conference presentation: this paper has been presented at CSU-ESDD Meeting [Rome] on 13 June 13 2019, and at the Ninth S-ECCO Masterclass in collaboration with ESC at the Fifteenth ECCO Congress [Vienna] on 13 February 13 2020.

References

- Magro F, Gionchetti P, Eliakim R, et al.; European Crohn's and Colitis Organisation [ECCO]. Third European evidence-based consensus on diagnosis and management of ulcerative colitis. Part 1: definitions, diagnosis, extra-intestinal manifestations, pregnancy, cancer surveillance, surgery, and ileo-anal pouch disorders. *J Crohns Colitis* 2017;11:649–70.
- Burisch J, Jess T, Martinato M, Lakatos PL; ECCO -EpiCom. The burden of inflammatory bowel disease in Europe. *J Crohns Colitis* 2013;7:322–37.
- Dignass A, Lindsay JO, Sturm A, et al. Second European evidence-based consensus on the diagnosis and management of ulcerative colitis. Part 2: current management. *J Crohns Colitis* 2012;6:991–1030.
- Øresland T, Bemelman WA, Sampietro GM, et al.; European Crohn's and Colitis Organisation [ECCO]. European evidence based consensus on surgery for ulcerative colitis. *J Crohns Colitis* 2015;9:4–25.
- Uzzan M, Cosnes J, Amiot A, et al. Long-term follow-up after ileorectal anastomosis for ulcerative colitis: a GETAID/GETAID chirurgie multicentre retrospective cohort of 343 patients. *Ann Surg* 2017;266:1029–34.
- Khan N, Cole E, Shah Y, Paulson EC. Segmental resection is a safe oncological alternative to total proctocolectomy in elderly patients with ulcerative colitis and malignancy. *Colorectal Dis* 2017;19:1108–16.
- Krugliak Cleveland N, Ollech JE, Colman RJ, et al. Efficacy and follow-up of segmental or subtotal colectomy in patients with colitis-associated neoplasia. *Clin Gastroenterol Hepatol* 2019;17:205–6.
- Schroeder KW, Tremaine WJ, Ilstrup DM. Coated oral 5-aminosalicylic acid therapy for mildly to moderately active ulcerative colitis. A randomized study. *N Engl J Med* 1987;317:1625–9.
- D'Haens G, Sandborn WJ, Feagan BG, et al. A review of activity indices and efficacy end points for clinical trials of medical therapy in adults with ulcerative colitis. *Gastroenterology* 2007;132:763–86.
- Rutgeerts P, Sandborn WJ, Feagan BG, et al. Infliximab for induction and maintenance therapy for ulcerative colitis. *N Engl J Med* 2005;353:2462–76.
- von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology [STROBE] statement: guidelines for reporting observational studies. *Lancet* 2007;370:1453–7.
- Sampietro GM, Colombo F, Frontali A, et al. Totally laparoscopic, multi-stage, restorative proctocolectomy for inflammatory bowel diseases. A prospective study on safety, efficacy and long-term results. *Dig Liver Dis* 2018;50:1283–91.
- Mege D, Frontali A, Pellino G, et al. Laparoscopic subtotal colectomy with double-end ileosigmoidostomy in right iliac fossa facilitates second-stage surgery in patients with inflammatory bowel disease. *Surg Endosc* 2020;34:186–91.
- Richards DM, Hughes SA, Irving MH, Scott NA. Patient quality of life after successful restorative proctocolectomy is normal. *Colorectal Dis* 2001;3:223–6.
- Colombo F, Sahami S, de Buck Van Overstraeten A, et al. Restorative proctocolectomy in elderly IBD patients: A multicentre comparative study on safety and efficacy. *J Crohns Colitis* 2017;11:671–9.
- 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-centre study. *Ann Surg* 2013;258:275–82.
- Lindberg J, Stenling R, Palmqvist R, Rutegård J. Surgery for neoplastic changes in ulcerative colitis – can limited resection be justified? Outcome for patients who underwent limited surgery. *Colorectal Dis* 2006;8:551–6.
- Worley G, Nordenvall C, Askari A, et al. Restorative surgery after colectomy for ulcerative colitis in England and Sweden: observations from a comparison of nationwide cohorts. *Colorectal Dis* 2018;20:804–12.
- Bartels SA, D'Hoore A, Cuesta MA, Bendsorp AJ, Lucas C, Bemelman WA. Significantly increased pregnancy rates after laparoscopic restorative proctocolectomy: a cross-sectional study. *Ann Surg* 2012;256:1045–8.