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ORIGINAL ARTICLE

Rectal Stump Management After Subtotal Colectomy for Severe Colitis, In or Out? A Retrospective Cohort Study

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Abstract

There is little evidence to guide optimal medical and surgical management of the rectal stump in patients undergoing subtotal colectomy (STC) for severe colitis (SC) and acute severe ulcerative colitis (ASUC). All patients undergoing an STC for SC and ASUC at the Royal Adelaide Hospital (RAH), Australia, between 1993 and 2018 were identified and included from the RAH inflammatory bowel disease database and hospital records. Patient demographics, postoperative medical and surgical outcomes, and second-stage procedures were analyzed. Sixty-one patients underwent an STC for SC including ASUC. In 21 patients, the rectal stump was left in situ, whereas in 40, the rectal stump was extra-fascial. Thirty-five of the 61 patients underwent surgery for ASUC, of whom 10 were in the in situ group and 25 in the extra-fascial group. Baseline patient characteristics were similar, except for a significantly higher American Society of Anaesthesiologists score (*P* 0.024) in the extra-fascial ASUC group. There were no statistically significant differences in the postoperative outcomes between the extra-fascial group and the in situ group for SC and ASUC. There was, however, a trend toward lower rates of systemic sepsis (1 (4%) vs 3 (30%), *P* 0.061) and pelvic sepsis (1 (4%) vs 2 (20%), *P* 0.190) in the extra-fascial compared with the in situ group in the ASUC subset. In our experience, exteriorization of the rectal stump after STC for ASUC may confer a lower systemic and pelvic sepsis rate compared with the in situ group; however, better powered prospective studies with larger numbers are required to confirm this.

Keywords In situ · Extra-fascial · Rectal stump · Inflammatory bowel disease · Emergency subtotal colectomy

Introduction

Severe colitis (SC) is an inflammatory condition of the colon that encompasses a wide array of diagnoses, including autoimmune conditions (such as ulcerative colitis (UC) and Crohn's disease), infective causes (e.g., clostridium difficile and Salmonella), and ischaemia.

UC is an autoimmune disease which causes chronic relapsing and remitting inflammation of the colon, [1] and its incidence is high in Western regions such as Northern Europe (24:100,000), Canada (19:100,000), and Australia (17:100,000) [1, 2]. Most UC patients can be treated conservatively with systemic and/or topical medications such as mesalazine, hydrocortisone, azathioprine, 6-MP, and infliximab [1]. Some patients, however, fail to respond to this medical management and present with severe acute UC (ASUC) requiring hospital admission for intravenous therapy [3]. Even this intensive medical therapy fails in approximately 30% of these patients. The standard approach in this scenario is generally an urgent subtotal colectomy (STC) as definitive treatment for severe, untreatable symptoms, or an emergency operation due to hemorrhage, toxic megacolon, or perforation [4, 5].

STC with the formation of an end ileostomy and preservation of the rectal stump has established itself as the preferred emergency operation for refractory SC and ASUC [4–9]. This procedure effectively manages the immediate disease, and affords the possibility of a future restorative procedure by means of an ileoanal pouch anastomosis (IPAA) when completion proctectomy is required, or an ileorectal anastomosis (IRA) in cases of rectal sparing [5, 6, 10, 11]. Evidence for the optimal surgical and medical management of the preserved rectal

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stump is minimal and inconclusive, and generally based on historical data and surgeon/physician preference [4, 12, 13]. With regards to surgical management, the rectal stump is either closed intraperitoneally in the pelvis (in situ position; Fig. 1), or exteriorized as a formal mucous fistula—placed subcutaneously at the lower end of an incision (extra-fascial position; Fig. 1) [6, 13–15]. Similarly, there is no consensus for the best medical management for rectal stump postoperatively and treatment ranges from nothing to topical and systemic anti-inflammatory medication [3].

The current study aims to evaluate the current practice at a single inflammatory bowel (IBD) tertiary referral center, in order to identify the optimal surgical and medical management of the rectal stump after an STC for severe colitis.

Materials and Methods

The study group consisted of patients who underwent an open or laparoscopic STC for SC (including ASUC) at Royal Adelaide Hospital (RAH) in Adelaide, South Australia, over a 15-year period between January 1993 and August 2018. Patients were identified using the operating room management information system (ORMIS) and the RAH IBD database using the procedure codes for "subtotal colectomy" or "colectomy". The exclusion criteria were the following: patients younger than 16 years old, patients with cancer, patients who had proctocolectomy, patients who had primary single-stage reconstructive surgery forming an ileorectal anastomosis (IRA) or ileal pouch-anal anastomosis (IPAA), and patients with missing operative or outcome data. This research was conducted in-line with the STROCSS guideline [16].

Patient and treatment characteristics including diagnosis, postoperative outcomes, and morbidity data were collected from the electronic and paper medical and operation records. Data collected included the following: age, gender, body mass index (BMI), American Society of Anaesthesiologists (ASA) score, [17] date of diagnosis, date of operation, IBD medication at the time of surgery, preoperative severity of disease according to Truelove and Witt's criteria [18], operative approach (laparoscopic or open), rectal stump placement (in situ or extra-fascial), rectal tube placement, postoperative topical

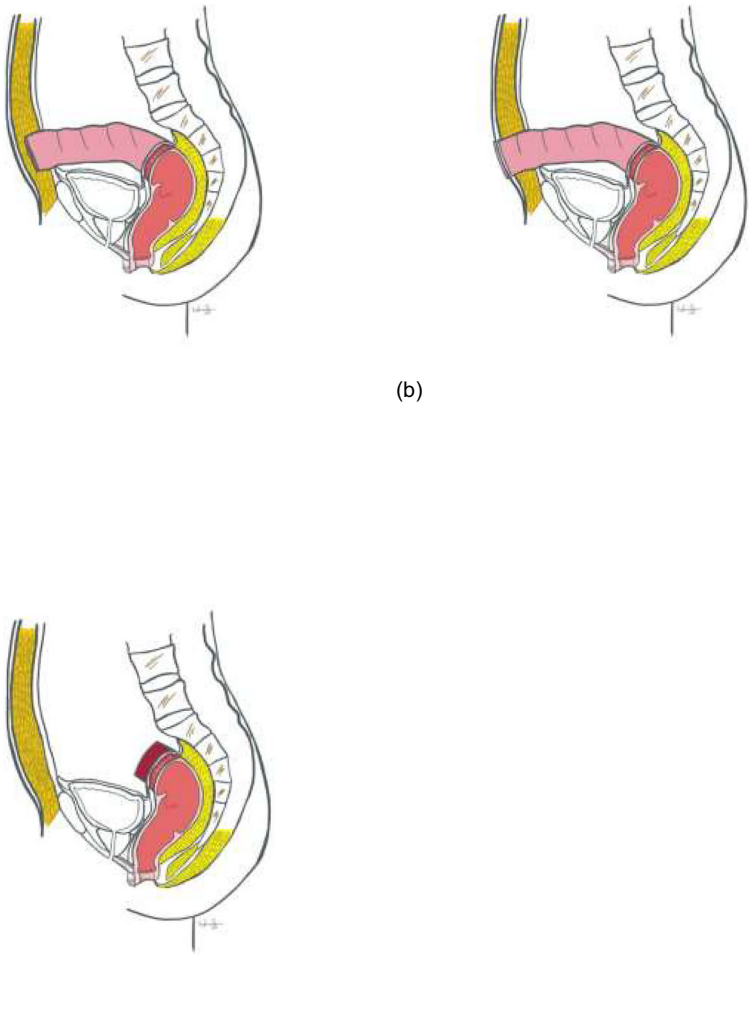

Fig. 1 Rectal stump placed **a** subcutaneously, **b** mucous fistula, and **c** intraperitoneally

and systemic medical treatment, postoperative complications (including systemic sepsis, pelvic sepsis, wound infection, and overall 30-day complications graded as per the Clavien-Dindo classification [19]), mortality (grade 5 Clavien-Dindo classification) was defined as death within 30 days after surgery, length of hospital stay (LOS), and readmission. Additional elective procedures performed later such as completion proctectomy or reconstructions through an ileorectal anastomosis (IRA) or ileal pouch-anal anastomosis (IPAA) were also noted.

Both SC and ASUC were defined according to Truelove and Witt's criteria as the presence of more than 6 bloody stools along with any one of the following: tachycardia > 90 bpm, fever > 37.8 °C, Hb < 10.5 gm/dL, and/or ESR > 30 mm/h [18, 20].

Statistical analyses were performed using GraphPad Prism software version 7 (GraphPad Software Inc., San Diego, CA). Continuous variables were expressed as mean (standard deviation) for parametric data and median (range) for non-parametric. Categorical and binary variables were summarized as a total followed by a percentage. The Fisher exact test was used for smaller patient numbers ($n \leq 5$), and the chi-square test was used for larger patient numbers ($n > 5$) to analyze categorical variables. The Welch's *t* test was used for continuous parametric data, and the Mann-Whitney U test was used for continuous non-parametric data.

The study was approved by the Central Adelaide Local Health Network Human Research Ethics Committee (CALHN HREC R20180217).

Results

Patient Characteristics

During the study period, 104 patients underwent a STC. Forty-three patients were excluded based on our pre-defined criteria (see supplementary material 1). Of the remaining 61 patients who underwent STC for SC, 21 (34%) of them had an in situ rectal stump, whereas 40 (66%) had an extra-fascial rectal stump. Among those 61 patients, 41 were operated for severe UC; however, six patients underwent elective procedures due to severely strictured rectum, colonic carcinoma, pregnancy, and rectal bleeding and thus were excluded. In total, 35 (57%) had STC for ASUC, 10 (29%) with the rectal stump in situ, and 25 (71%) with the rectal stump extra-fascial.

Baseline patient and disease characteristics for both the SC and the ASUC cohorts are summarized in Table 1. There was no difference in baseline characteristics between both groups (in situ group and extra-fascial group) in either cohort, except that the ASA score was higher in the extra-fascial group (*P*

Table 1 Baseline patient and disease characteristics

	Severe colitis			ASUC subset[a]		
	In situ (n = 21)	Extra-fascial (n = 40)	*P*- value	In situ (n = 10)	Extra-fascial (n = 25)	*P*- value
Age at surgery, mean, *y* (SD)	40.3 (15.7)	41.4 (16.7)	0.816	38 (13.1)	44 (15.8)	0.258
Gender, *n* (%)			0.978			0.908
Male	12 (57)	23 (58)		7 (70)	17 (68)	
Female	9 (43)	17 (43)		3 (30)	8 (32)	
BMI, kg/m^2,and mean (SD)	25.3 (7.3)	26.1 (6.4)	0.705	24.6 (5.0)	26.1 (5.0)	0.423
ASA score [17]			0.440			0.024
1	1 (5)	0 (0)		1 (10)	0 (0)	
2	11 (52)	18 (45)		7 (70)	13 (52)	
3	6 (29)	17 (43)		0 (0)	11 (44)	
4	3 (14)	5 (13)		2 (20)	1 (4)	
Ulcerative colitis	15 (71)	26 (65)	0.611	N/A	N/A	
Crohn's disease	5 (24)	8 (20)	0.729	N/A	N/A	
Clostridium difficile	0 (0)	3 (8)	0.544	N/A	N/A	
Ipilimumab colitis	0 (0)	2 (5)	0.541	N/A	N/A	
Salmonella colitis	0 (0)	1 (3)	> 0.999	N/A	N/A	
Undetermined colitis	1 (5)	0 (0)	0.344	N/A	N/A	
Duration of IBD prior to surgery, years, and median (range)	1.2 (0.003–20.5)	2.5 (0–16.4)	0.458	0.1 (0.003–13)	1 (0–16.4)	0.343
Preoperative albumin level, g/L, and mean (SD)	24.2 (8.0)	23.5 (7.3)	0.738	24.7 (7.5)	24.0 (6.6)	0.790

IBD inflammatory bowel disease, *SD* standard deviation

[a] Acute attack of severe ulcerative colitis (based on Truelove and Witt's criteria[24]) requiring emergency hospitalization

0.024) vs in situ group within the ASUC subset. Duration of IBD before surgery was longer for patients with an extra-fascial rectal stump in both the SC patients (1.2 vs 2.5 years, *P* 0.458) and specifically the ASUC subset (0.1 vs 1 year, *P* 0.343), but this was not statistically significant.

Intraoperative Techniques

The intraoperative techniques are summarized in Table 2. Overall, an open approach was more often used (69%). In the ASUC patients, 40% undergoing laparoscopic surgery had their rectal stump left in situ versus around 60% in those undergoing open surgery (*P* 0.477). A trans-anal rectal tube was placed in the majority of the patients regardless of etiology or stump placement location.

Postoperative Outcomes, Morbidity, and Mortality

Postoperative outcomes, morbidity, and mortality are summarized in Table 3. In SC cases, the rates of wound infection, pelvic sepsis, and systemic sepsis between the in situ group and the extra-fascial group were 3 vs 6 (14% vs 15%, *P* 0.940), 4 vs 3 (19% vs 8%, *P* 0.219), and 5 vs 3 (24% vs 8%, *P* 0.110), respectively. The incidence of overall postoperative complications was 26 (65%) in the extra-fascial group vs 16 (76%) in the in situ group (*P* 0.369). Mortality (grade 5) occurred in 1 (5%) case in the in situ group vs 1 (3%) case in the extra-fascial group. The median postoperative LOS for patients with an in situ rectal stump 14 (4–59) days was significantly shorter than those with an extra-fascial rectal stump 23 (6–85) days (*P* 0.014). There were no significant differences in the use of postoperative oral, intravenous, topical, or combined medications between the in situ and extra-fascial groups.

In ASUC cases, the rates of wound infection, pelvic sepsis, and systemic sepsis comparing in situ group with extra-fascial group were 1 vs 5 (10% vs 17%, *P* 0.649), 2 vs 1 (20% vs 4%, *P* 0.190), and 3 vs 1 (30% vs 4%, *P* 0.061), respectively. Overall postoperative complications occurred in 16 (64%) cases in the extra-fascial group vs 7 (70%) cases in the in situ group (*P* 0.735). Mortality (grade 5) occurred in 1 (10%) case in the in situ group vs 1 (4%) case in the extra-fascial group. The median postoperative LOS for patients with an in situ rectal stump 19 (4–59) days did not differ compared with those with an extra-fascial rectal stump 20 (8–85) days (*P* 0.266). Once again, no significant differences in postoperative oral, intravenous, topical, or combined treatments in ASUC between the in situ and extra-fascial groups were observed.

Subsequent Completion Proctectomy and Reconstructive Procedures

As shown in Table 4, there was no significant difference in the number of SC and ASUC patients that underwent elective completion proctectomy between either the in situ or the extra-fascial groups. Almost a third of the patients underwent a reconstructive procedure, with IPAA being the most frequent operation (14 in SC patients and 11 in ASUC patients) without a significant difference between the in situ and the extra-fascial groups.

Discussion

We present herein a single tertiary center retrospective cohort study analyzing surgical and medical rectal stump management outcomes for 61 patients undergoing an emergency subtotal colectomy for severe colitis. There was little in the way of statistically significant differences in the postoperative septic outcomes between the extra-fascial group and the in situ group for SC and ASUC. There was, however, a trend toward lower incidence of systemic sepsis (1(4%) vs 3(30%), *P* 0.061) and pelvic sepsis (1 (4%) vs 2 (20%), *P* 0.190) after ASUC in the extra-fascial compared with the in situ group.

The literature on management of the rectal stump after colectomy for colitis has been variable, with some reports suggesting that leaving a closed rectal stump in situ may be a safe option in certain patients [6, 9, 21, 22]. However, given the high reported morbidity and mortality rates of 20% and 5%, respectively, some surgeons understandably fear this option due to risk of stump blowout [22, 23]. This can then perpetuate ongoing infection, pelvic sepsis, septic shock, and even death [21, 22, 24]. Also, an in situ placement makes future reconstructive surgery potentially more challenging since the rectal stump is shorter and likely adherent to adjacent tissues in the lower pelvis [21, 23]. A formal mucous fistula

Table 2 Intraoperative techniques

	Severe colitis			ASUC subset		
	In situ (*n* = 21)	Extra-fascial (*n* = 40)	*P*-value	In situ (*n* = 10)	Extra-fascial (*n* = 25)	*P*-value
Surgical approach, *n* (%)			0.396			0.477
Laparoscopic	8 (38)	11 (28)		4 (40)	7 (28)	
Open	13 (62)	29 (73)		6 (60)	18 (72)	
Transanal rectal tube placement, *n* (%)	15 (71)	28 (70)	0.908	8 (80)	19 (76)	0.799

Table 3 Postoperative outcomes, morbidity, and mortality

	Severe colitis			ASUC subset		
	In situ (n = 21)	Extra-fascial (n = 40)	P-value	In situ (n = 10)	Extra-fascial (n = 25)	P -value
Surgical outcomes						
Wound infection, n (%)	3 (14)	6 (15)	0.940	1 (10)	5 (17)	0.649
Pelvic sepsis, n (%)	4 (19)	3 (8)	0.219	2 (20)	1 (4)	0.190
Systemic sepsis, n (%)	5 (24)	3 (8)	0.110	3 (30)	1 (4)	0.061
Postoperative complications according to Clavien-Dindo classification [19], n (%)						
Overall	16 (76)	26 (65)	0.369	7 (70)	16 (64)	0.735
Grade 1	4 (19)	4 (10)		2 (20)	2 (8)	
Grade 2	7 (33)	13 (33)		1 (10)	7 (28)	
Grade 3a	0 (0)	5 (13)		0 (0)	1 (4)	
Grade 3b	4 (19)	5 (13)		2 (20)	5 (20)	
Grade 4	0 (0)	0 (0)		0 (0)	0 (0)	
Grade 5	1 (5)	1 (3)		1 (10)	1 (4)	
LOS, days, and median (range)	14 (4–59)	23 (6–85)	0.014	19 (4–59)	20 (8–85)	0.266
Postoperative medical management						
Oral or intravenous medications	9 (43)	24 (60)	0.202	5 (50)	16 (64)	0.445
Use of enema or suppository	2 (10)	1 (3)	0.270	1 (10)	1 (4)	0.496
Combined medications[a]	2 (10)	6 (15)	0.547	2 (20)	6 (24)	0.799
Postoperative RBC transfusion, n (%)	5 (24)	10 (25)	0.918	3 (30)	6 (24)	0.714

LOS length of stay, *RBC* red blood cell

[a] Combination of topical and systemic medications

and subcutaneous exteriorization of the rectal stump have been reported as an alternative to in situ placement. In several studies, exteriorization has been shown to reduce the incidence of postoperative pelvic sepsis and overall complications, despite a higher rate of wound infections [4, 13, 23, 25, 26]. Trickett et al. reported a pelvic sepsis rate of 0% and an overall complication rate of 30% for exteriorization of the rectal stump in 10 patients. Ng et al. showed similar results with a 3% pelvic sepsis rate and a 24% overall postoperative complications rate in 29 severe UC patients. Wound infection rates varied between 6% and 30% in these studies. Our current study shows similar rates of pelvic sepsis (4%) with comparatively higher rates of wound infections (17%). However, despite an obvious trend favoring extra-fascial placement, we could not demonstrate a statistically significant difference in postoperative septic outcomes as reported in previous studies, likely due to limited patient numbers making the analysis underpowered.

In our series, we observed a shorter LOS for an in situ rectal stump compared with an extra-fascial rectal stump in SC patients (14 (4–59) vs. 23 (6–85) days; P 0.014), respectively. Conversely, Trickett et al. reported a significantly shorter LOS in patients with an extra-fascial rectal stump with a median of 8 days, compared with those with an in situ rectal stump

Table 4 Additional elective resections and reconstructive procedures

	Severe colitis			ASUC subset		
	In situ (n = 21)	Extra-fascial (n = 40)	P-value	In situ (n = 10)	Extra-fascial (n = 25)	P-value
Completion proctectomy, n (%)	7 (33)	13 (33)	0.948	5 (50)	11 (44)	0.748
Time period from STC to completion proctectomy, months, and median (range)	8 (5–20)	9 (3–17)	0.617	8 (6–20)	9.5 (3–15)	0.678
Reconstruction, n (%)	6 (29)	13 (33)	0.753	4 (40)	8 (32)	0.652
IPAA, n (%)	5 (24)	9 (23)		3 (30)	8 (32)	
IRA, n (%)	1 (5)	4 (10)		1 (10)	0 (0)	
Preoperative albumin level, g/L, mean (SD) [c]	30.7 (3.4)	32.3 (6.3)	0.497	30.3 (4.1)	32.7 (7.4)	0.495

IPAA Ileal pouch-anal anastomosis, *IRA* ileorectal anastomosis, *SD* standard deviation

(median 15 days). While the shorter LOS for in situ placement in our series is potentially due to lower wound morbidity, but this could also be due to selection bias for the more severe cases with fulminant rectal involvement were managed with extra-fascial rectal stump with higher wound infections prolonging LOS. It is notable that there was no difference in the ASUC group where the difference in extent of rectal stump involvement would be less disparate.

There is limited evidence on the medical management of the rectal stump after emergency STC. Topical rectal washout with 5-ASA's and steroids has been reported in some series [15, 23, 27], and, to date, no study has reported on the combined treatment of topical and systemic medications. In our present experience, even though a higher number of patients received oral and combined (systemic and topical) medications in the extra-fascial stump group, this did not show statistical significant differences when compared to the in situ group.

Our practice of transanally placing a Foley's catheter to decompress the rectum with the aim to reduce sepsis rates after an emergency STC is in accordance to current standard practice; however, the actual benefit of this, whether the stump is left in situ or placed extra-fascially, remains unclear [5, 28].

We recognize that this study has limitations. There is a risk of selection bias by inherent retrospective nature of the study. However, the authors feel, considering that there was little difference in disease severity at baseline between the groups, that the decisions regarding the type of management patients received was influenced largely by the surgeons'/gastroenterologist's preference (particularly in the ASUC subset), based predominantly on anecdotal institutional practice. As previously stated, our study did not reach statistically significant differences for either surgical placement options of the rectal stump. Perhaps in a larger cohort of patients, statistical significance could be achieved, and in the future, efforts should be made to aim for a larger patient cohort study from a collaborative multicenter approach.

Conclusion

In our experience, exteriorization of the rectal stump after STC for ASUC may confer a lower systemic and pelvic sepsis rates compared with leaving the rectal stump in situ; however, better powered prospective studies with larger numbers are required to confirm this.

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Compliance with Ethical Standards

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

References

1. Ungaro R, Mehandru S, Allen PB, Peyrin-Biroulet L, Colombel JF (2017) Ulcerative colitis. Lancet 389(10080):1756–1770. https://doi.org/10.1016/S0140-6736(16)32126-2
2. Molodecky NA, Soon IS, Rabi DM, Ghali WA, Ferris M, Chernoff G, Benchimol EI, Panaccione R, Ghosh S, Barkema HW, Kaplan GG (2012) Increasing incidence and prevalence of the inflammatory bowel diseases with time, based on systematic review. Gastroenterology 142(1):46–54 e42; quiz e30. https://doi.org/10.1053/j.gastro.2011.10.001
3. Carter MJ, Lobo AJ, Travis SP, Ibd Section BSoG (2004) Guidelines for the management of inflammatory bowel disease in adults. Gut 53 Suppl 5:V1-16. doi:https://doi.org/10.1136/gut.2004.043372
4. Gu J, Stocchi L, Remzi F, Kiran RP (2013) Intraperitoneal or subcutaneous: does location of the (colo) rectal stump influence outcomes after laparoscopic total abdominal colectomy for ulcerative colitis? Dis Colon Rectum 56(5):615–621. https://doi.org/10.1097/DCR.0b013e3182707682
5. Grucela A, Steinhagen RM (2009) Current surgical management of ulcerative colitis. Mt Sinai J Med 76(6):606–612. https://doi.org/10.1002/msj.20152
6. Buchs NC, Bloemendaal ALA, Wood CPJ, Travis S, Mortensen NJ, Guy RJ, George BD (2017) Subtotal colectomy for ulcerative colitis: lessons learned from a tertiary centre. Color Dis 19(5):O153–O161. https://doi.org/10.1111/codi.13658
7. Katz JA (2000) Medical and surgical management of severe colitis. Semin Gastrointest Dis 11(1):18–32
8. Alves A, Panis Y, Bouhnik Y, Maylin V, Lavergne-Slove A, Valleur P (2003) 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 197(3):379–385. https://doi.org/10.1016/S1072-7515(03)00434-4
9. McKee RF, Keenan RA, Munro A (1995) Colectomy for acute colitis: is it safe to close the rectal stump? Int J Color Dis 10(4):222–224
10. Gu J, Stocchi L, Remzi FH, Kiran RP (2014) Total abdominal colectomy for severe ulcerative colitis: does the laparoscopic approach really have benefit? Surg Endosc 28(2):617–625. https://doi.org/10.1007/s00464-013-3218-7
11. Scoglio D, Ahmed Ali U, Fichera A (2014) Surgical treatment of ulcerative colitis: ileorectal vs ileal pouch-anal anastomosis. World J Gastroenterol 20(37):13211–13218. https://doi.org/10.3748/wjg.v20.i37.13211
12. Brady RR, Collie MH, Ho GT, Bartolo DC, Wilson RG, Dunlop MG (2008) Outcomes of the rectal remnant following colectomy for ulcerative colitis. Color Dis 10(2):144–150. https://doi.org/10.1111/j.1463-1318.2007.01224.x
13. Trickett JP, Tilney HS, Gudgeon AM, Mellor SG, Edwards DP (2005) Management of the rectal stump after emergency sub-total colectomy: which surgical option is associated with the lowest morbidity? Color Dis 7(5):519–522. https://doi.org/10.1111/j.1463-1318.2005.00875.x
14. Russell TA, Dawes AJ, Graham DS, Angarita SAK, Ha C, Sack J (2018) Rescue diverting loop ileostomy: an alternative to emergent colectomy in the setting of severe acute refractory IBD-Colitis. Dis Colon Rectum 61(2):214–220. https://doi.org/10.1097/DCR.0000000000000985
15. Bohm G, O'Dwyer ST (2007) The fate of the rectal stump after subtotal colectomy for ulcerative colitis. Int J Color Dis 22(3):277–282. https://doi.org/10.1007/s00384-006-0127-4
16. Agha RA, Borrelli MR, Vella-Baldacchino M, Thavayogan R, Orgill DP, Group S (2017) The STROCSS statement: strengthening

the reporting of cohort studies in surgery. Int J Surg 46:198–202. https://doi.org/10.1016/j.ijsu.2017.08.586
17. Daabiss M (2011) American Society of Anaesthesiologists physical status classification. Indian J Anaesth 55(2):111–115. https://doi.org/10.4103/0019-5049.79879
18. Truelove SC, Witts LJ (1955) Cortisone in ulcerative colitis; final report on a therapeutic trial. Br Med J 2(4947):1041–1048
19. Dindo D, Demartines N, Clavien PA (2004) Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 240(2):205–213
20. Chen JH, Andrews JM, Kariyawasam V, Moran N, Gounder P, Collins G, Walsh AJ, Connor S, Lee TW, Koh CE, Chang J, Paramsothy S, Tattersall S, Lemberg DA, Radford-Smith G, Lawrance IC, McLachlan A, Moore GT, Corte C, Katelaris P, Leong RW, Organisation IBDS, the Australian Inflammatory Bowel Diseases Consensus Working G (2016) Review article: acute severe ulcerative colitis-evidence-based consensus statements. Aliment Pharmacol Ther 44(2):127–144. https://doi.org/10.1111/apt.13670
21. Kyle SM, Steyn RS, Keenan RA (1992) Management of the rectum following colectomy for acute colitis. Aust N Z J Surg 62(3):196–199
22. Wojdemann M, Wettergren A, Hartvigsen A, Myrhoj T, Svendsen LB, Bulow S (1995) Closure of rectal stump after colectomy for acute colitis. Int J Color Dis 10(4):197–199
23. Carter FM, McLeod RS, Cohen Z (1991) Subtotal colectomy for ulcerative colitis: complications related to the rectal remnant. Dis Colon Rectum 34(11):1005–1009
24. Schein M, Kopelman D, Nitecki S, Hashmonai M (1993) Management of the leaking rectal stump after Hartmann's procedure. Am J Surg 165(2):285–287
25. Ng RL, Davies AH, Grace RH, Mortensen NJ (1992) Subcutaneous rectal stump closure after emergency subtotal colectomy. Br J Surg 79(7):701–703
26. Uchino M, Ikeuchi H, Matsuoka H, Takahashi Y, Tomita N, Takesue Y (2013) Surgical site infection and validity of staged surgical procedure in emergent/urgent surgery for ulcerative colitis. Int Surg 98(1):24–32. https://doi.org/10.9738/CC83.1
27. Pal S, Sahni P, Pande GK, Acharya SK, Chatttopadhyay TK (2005) Outcome following emergency surgery for refractory severe ulcerative colitis in a tertiary care centre in India. BMC Gastroenterol 5:1–8. https://doi.org/10.1186/1471-230X-5-39
28. Fornaro R, Caratto E, Caratto M, Sticchi C, Salerno A, Bianchi R, Scabini S, Casaccia M (2017) Surgery of acute severe ulcerative colitis. Subtotal colectomy: when and how to do it? European Surgery - Acta Chirurgica Austriaca 49(3):108–112. https://doi.org/10.1007/s10353-016-0458-5

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