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Possible Overuse of 3-Stage Procedures for Active Ulcerative Colitis

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IMPORTANCE There is an assumption that patients treated with 3-stage procedures for active ulcerative colitis are undergoing a safer surgical approach and thus spared the complications associated with a 2-stage procedure. However, there is a paucity of data addressing the validity of this assumption, and the optimal staging approach for patients traditionally considered at high risk for anastomotic leak remains unclear.

OBJECTIVES To identify factors associated with 3- vs 2-stage procedures and to determine their impact on surgical outcomes.

DESIGN Retrospective analysis of patients who underwent 2-stage or 3-stage ileal pouch–anal anastomosis (IPAA) surgery for active ulcerative colitis due to failure of medical management over a 10.5-year period (September 1, 2000, to March 30, 2011). The mean (SEM) follow-up was 5.15 (0.24) years (range, 0.26-11.09 years).

SETTING Single large academic medical center.

PATIENTS One hundred forty-four patients treated with 3- or 2-stage IPAA surgery for active ulcerative colitis. Among these patients, 77 were male and 67 were female. The mean (SEM) age was 34.6 (1.0) years (range, 11-67 years). Of the 144 patients, 116 (80.6%) had a 2-stage procedure and 28 (19.4%) had a 3-stage procedure.

INTERVENTIONS Two-stage vs 3-stage IPAA procedures for active ulcerative colitis.

MAIN OUTCOMES AND MEASURES Factors leading to decision for 3-stage procedure, postoperative outcomes with 3-stage vs 2-stage procedures, and risks for complications in patients undergoing 3-stage vs 2-stage procedures.

RESULTS Of 144 patients, only 19.4% had a 3-stage procedure. Decision to perform a 3-stage vs 2-stage procedure was affected by emergent status ($P < .001$) and hemodynamic instability ($P = .04$) but not by age, sex, body mass index, use of steroids, or use of anti–tumor necrosis factor agents. For patients with 2-stage procedures, multivariate regression revealed that the number of perioperative complications was affected by surgeon experience ($P = .02$) but not by emergent status, use of steroids, or use of anti–tumor necrosis factor agents. Two-stage procedures were associated with more perioperative complications on univariate analysis ($P = .05$), but multivariate regression suggested that this difference was due to surgeon experience ($P = .02$) rather than to creation of an IPAA at the first operation ($P = .55$). Importantly, 2-stage procedures did not change the risk of anastomotic leak when all operations were taken into account (odds ratio = 1.09; $P = .94$). In the long term (mean [SEM], 5.2 [0.2] years), patients who underwent 2-stage surgery had a lower risk of anal stricture (odds ratio = 8.21; $P = .01$) and no differences in fistula or abscess formation or in pouch failure.

CONCLUSIONS AND RELEVANCE In patients with active ulcerative colitis, use of steroids and anti–tumor necrosis factor agents alone do not appear to justify the decision to avoid IPAA creation at the first operation provided that it is performed by a high-volume inflammatory bowel disease surgeon.

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Ulcerative colitis (UC) is a form of inflammatory bowel disease that currently affects more than 500 000 adults and children in the United States.[1] Although a number of medical therapies are available to manage the disease, nearly 20% of affected patients will eventually require surgical intervention secondary to failure of medical management.[2] The advent of the ileal pouch-anal anastomosis (IPAA) procedure[3] has enabled patients who require total proctocolectomy to achieve postoperative bowel continence. By constructing a small-bowel pouch that serves as a fecal reservoir, patients are able to avoid the psychological and social challenges associated with a permanent ostomy.[4-6]

The IPAA procedure is usually completed in 2 stages.[3] In the first stage, patients undergo total proctocolectomy with IPAA and temporary diverting loop ileostomy. In the second stage, the ostomy is reversed and bowel continuity is restored. Staging can be modified by forgoing diversion at the first surgery (ie, a 1-stage procedure) or by performing a subtotal colectomy in a separate procedure prior to creating the diverted IPAA (ie, a 3-stage procedure). The latter technique is generally reserved for patients with severe active disease, those using long-term or high doses of steroid therapy, or in cases in which the diagnosis is unclear (ie, UC vs Crohn disease).[7] By using a 3-stage approach in acutely ill patients, it is thought that the overall outcomes will be improved because patient health status and immunosuppression will have time to recover prior to forming the IPAA, which can be susceptible to leak.[8,9] Patient factors, surgeon preference, and surgeon training may also play a role in the staging of patients with UC for IPAA procedures, and rates of 3-stage procedures for patients with severe disease vary tremendously between institutions and among surgeons.[10]

The frequently voiced assumption is that patients treated with 3-stage procedures are undergoing a safer surgical approach and are spared the complications associated with a 2-stage procedure. However, there is a paucity of data addressing the validity of this assumption. As such, the optimal staging approach for patients traditionally considered at high risk for anastomotic leak remains unclear.[10]

The objective of this study was therefore to determine whether a 3-stage approach is justified in patients perceived to be at high risk for postoperative complications. To answer this question, we first compared the characteristics of patients with active UC (aUC; ie, failing medical management) undergoing 2-stage vs 3-stage IPAA procedures at our institution. Second, we evaluated whether patients with aUC treated with 3-stage vs 2-stage procedures truly had improved perioperative and long-term outcomes.

Methods

Study Design

Approval to conduct this research was obtained from the hospital's institutional review board prior to initiation. The medical records of all patients undergoing 2-stage or 3-stage IPAA surgery for aUC between September 1, 2000, and March 30, 2011, at our institution were reviewed for inclusion in the study. Potential study patients were identified using a combination of review of surgeons' personal databases and an administrative query using *Current Procedural Terminology* codes. Patients who had an IPAA procedure for dysplasia, received an ileal-rectal anastomosis, were diagnosed as having Crohn disease or indeterminate colitis on postoperative pathology, or underwent a 1-stage procedure were excluded from the study.

Variables of Interest

For patients meeting the inclusion criteria, the medical records were queried to obtain the following: (1) patient demographic characteristics (age; sex; race; body mass index [BMI; calculated as weight in kilograms divided by height in meters squared]; age-adjusted Charlson Comorbidity Index[11]; American Society of Anesthesiologists score; number of prior abdominal operations; smoking status; use of steroids, antitumor necrosis factor [TNF] agents, or other immunomodulators [methotrexate, 6-mercaptopurine, azathioprine, cyclosporine] at the first operation; and reported daily preoperative bowel movements); (2) surgical procedure details (emergent status; staging [3-stage vs 2-stage]; laparoscopic procedure; surgical Apgar score[12]; and surgeon experience, ie, a high-volume inflammatory bowel disease [IBD] surgeon, defined as a surgeon who has performed ≥50 IPAA procedures either during colorectal surgery fellowship or in full-time practice); (3) pathological findings (ie, severe inflammation on pathology specimen as determined by a board-certified pathologist); (4) perioperative outcomes (abdominal sepsis [leak, abscess]; other infections [pneumonia, urinary tract infection, wound infection, line infection]; thrombotic complications [pulmonary embolus, deep vein thrombosis, line-associated thrombus]; and ileus or small-bowel obstruction, defined as >3 days between surgery and the patient's inability to tolerate a solid diet without nausea, vomiting, or abdominal distention and/or evidence of obstruction on radiographic studies[13]); (5) in-hospital length of stay; (6) hospital readmissions within 30 days of surgery; (7) long-term complications (pouchitis, defined as symptoms of pouchitis confirmed by inflammation on endoscopy and/or biopsy[14,15]; fistula or abscess; ileus or small-bowel obstruction [surgical and nonsurgical]; hernia; anal stricture; and pouch failure); and (8) total follow-up time. Emergent status was defined as any case that was scheduled for the operating room within 4 hours after the surgeon decided that the patient needed surgery, which was marked in the hospital records with an American Society of Anesthesiologists physical status classification that was followed by "E" (eg, American Society of Anesthesiologists classification 2E).

Statistical Analysis

Demographic and other baseline characteristics were summarized as mean (standard error of the mean) or count with percentage, as appropriate. To identify the predictors that encouraged surgeons to elect a 3-stage approach in their patients, the 3-stage vs 2-stage groups were compared using Pearson χ^2 or Fisher exact tests (categorical variables), 2-sample *t* tests (continuous variables), and a multivariate regression model. We then compared complications of patients treated with 3-stage vs 2-stage procedures using multivariate regression analyses that

Table 1. Patient Demographic Characteristics for the 3-Stage vs 2-Stage Ileal Pouch–Anal Anastomosis Groups

Variable	2-Stage (n = 116)	3-Stage (n = 28)	*P* Value
Age, mean (SEM), y	35.3 (1.2)	31.8 (2.4)	.18
Male, %	54.3	50.0	.68
Race, %			
White	88.3	89.3	.92
Hispanic	6.0	7.1	
Other	5.2	3.6	
BMI, mean (SEM)	25.2 (0.5)	23.8 (1.1)	.24
Age-adjusted CCI, mean (SEM)	0.41 (0.06)	0.18 (0.12)	.09
ASA score, mean (SEM)	2.10 (0.03)	2.04 (0.07)	.48
Prior abdominal operations, mean (SEM), No.	0.35 (0.07)	0.18 (0.14)	.26
Current smoker, %	1.7	7.1	.16
Steroid use at first operation, %	75.0	81.5	.48
Steroid dose at first operation, mean (SEM), mg	28.8 (3.7)	36.4 (7.5)	.36
Anti-TNF agent use at first operation, %	29.3	17.9	.22
Other immunomodulator use at first operation, %[a]	48.3	17.9	.004
Reported preoperative bowel movements, mean (SEM), No./d	10.5 (0.7)	13.2 (1.5)	.10
Emergent surgery, %	2.6	32.1	<.001
Laparoscopic procedure, %	15.5	25.0	.23
Surgery Apgar score, mean (SEM)	6.47 (0.12)	5.89 (0.27)	.04
High-volume IBD surgeon, %	87.9	89.3	.84
Severe disease on pathology at first operation, %	84.5	78.6	.45
Follow-up, mean (SEM), y	5.40 (0.26)	4.13 (0.53)	.04

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CCI, Charlson Comorbidity Index; IBD, inflammatory bowel disease; TNF, tumor necrosis factor.

[a] Includes methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine.

included any significant variables identified on univariate analysis as well as the following 8 a priori variables: presence of severe colonic disease on pathology at the first operation, age-adjusted Charlson Comorbidity Index, surgery Apgar score, steroid use at the first operation, anti-TNF agent use at the first operation, other immunomodulator use at the first operation, emergent status, and surgeon experience. A priori variables were selected based on a review of the literature and author discussion (2 of whom are colorectal surgeons). Follow-up time was also included in the model for analyses of long-term complications only. Incidence of complications and other outcome data were reported as least squares mean (standard error of the mean) based on regression model estimates. All tests were 2-tailed and performed at a significance level of .05. Statistical analyses were performed using JMP version 9.0 statistical software (SAS Institute, Inc).

Results

Patient Demographic Characteristics

A total of 144 patients (77 [53.5%] male, 67 [46.5%] female) with a mean (SEM) age of 34.6 (1.0) years (range, 11-67 years) underwent 2-stage or 3-stage procedures for aUC due to failure of medical management over a 10.5-year period (September 1, 2000, to March 30, 2011). Of those patients, 116 (80.6%) had a 2-stage procedure and 28 (19.4%) had a 3-stage procedure. Ten different surgeons performed the procedures, 6 of whom were high-volume inflammatory bowel disease surgeons. The mean (SEM) follow-up time for all patients was 5.15 (0.24) years (range, 0.26-11.09 years).

Factors Associated With 3-Stage vs 2-Stage Procedures

Three-stage procedures, compared with 2-stage procedures, were associated with a higher frequency of emergent status (32.1% vs 2.6%, respectively; $P < .001$) and greater intraoperative hemodynamic instability (mean [SEM] surgery Apgar score, 5.89 [0.27] vs 6.47 [0.12], respectively; $P = .04$). There were no significant differences in age, sex, race, BMI, age-adjusted Charlson Comorbidity Index, smoking status, number of prior abdominal operations, or reported number of preoperative daily bowel movements between groups (all $P > .05$) (**Table 1**). There were also no significant differences in the proportions of patients who underwent 3-stage vs 2-stage procedures who were using steroids ($P = .48$) or anti-TNF agents ($P = .22$) at the first operation (Table 1), although more patients who underwent 2-stage procedures were using other immunomodulators (ie, methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine) than patients who underwent 3-stage procedures (48.3% vs 17.9%, respectively; $P = .004$). There were no significant differences in the use of laparoscopy ($P = .23$) or surgeon experience ($P = .84$) between groups or in the frequency of severe colitis as judged by the pathologist ($P = .45$) (Table 1).

In a multivariate regression model comparing factors associated with 3-stage vs 2-stage procedures, higher Charlson Comorbidity Index scores (odds ratio = 3.91; 95% CI, 1.19-21.72; $P = .02$) and emergent surgery status (odds ratio = 27.20; 95% CI, 5.21-207.52; $P < .001$) were significantly associated with 3-stage procedures. Similar to the findings with univariate analysis, use of other immunomodulators (ie, methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine) was associated with lower odds of performing a 3-stage vs 2-stage procedure (odds ratio = 0.22; 95% CI, 0.06-0.71). The presence of severe dis-

Table 2. Univariate Analysis Comparing Perioperative and Long-term Outcomes After 3-Stage vs 2-Stage Ileal Pouch–Anal Anastomosis Procedures

Outcome	2-Stage (n = 116)	3-Stage (n = 28)	*P* Value
Perioperative			
Readmissions <30 d, %	32.8	30.8	.84
Total readmissions <30 d, mean (SEM), No.	0.52 (0.07)	0.71 (0.15)	.23
Readmissions <30 d per procedure, mean (SEM), No.	0.40 (0.05)	0.18 (0.09)	.04
Total perioperative complications at first operation, mean (SEM), No.	0.89 (0.09)	0.50 (0.18)	.05
Anastomotic leak, %	20.7	10.7	.22
Abdominal sepsis, %[a]	12.1	7.1	.46
Other infections, %[b]	0.9	0.0	.55
Thrombotic complications, %	30.2	23.1	.47
Ileus or SBO, %	20.7	10.7	.22
Death, %	0.0	0.0	NA
Total perioperative complications overall, mean (SEM), No.	1.18 (0.13)	1.29 (0.26)	.71
Anastomotic leak, %	10.3	3.6	.46
Abdominal sepsis, %[a]	21.6	21.4	.46
Other infections, %[b]	13.8	28.6	.06
Thrombotic complications, %	6.9	10.7	.49
Ileus or SBO, %	39.7	46.4	.51
Death, %	0.0	0.0	NA
Postoperative length of stay, mean (SEM), d			
IPAA	6.6 (0.4)	4.3 (0.8)	.01
Total	10.6 (0.6)	11.9 (1.3)	.38
Long-term			
Pouchitis, %	51.9	50.0	.86
Fistula or abscess, %	10.3	17.9	.27
Ileus or SBO, %	20.8	3.6	.03
Requiring surgery, %	9.5	3.6	.84
Hernia, %	2.9	3.6	.84
Stricture, %	7.6	17.9	.11
Pouch failure, %	6.7	3.6	.54
Total late complications, mean (SEM), No.	1.00 (0.10)	1.11 (0.19)	.62
Total perioperative and long-term complications, mean (SEM), No.	2.29 (0.18)	2.39 (0.34)	.79

Abbreviations: IPAA, ileal pouch–anal anastomosis; NA, not applicable; SBO, small-bowel obstruction.

[a] Anastomotic leak, rectal stump leak, or abscess.

[b] Pneumonia, urinary tract infection, wound infection, or line infection.

ease at the first operation, steroid use, anti-TNF agent use, surgeon experience, and surgery Apgar score were not significantly associated with operative staging in the model (all $P \geq .11$).

Cumulative Outcomes With 3-Stage vs 2-Stage Procedures

Patients with 3-stage vs 2-stage procedures had shorter in-hospital stays for their subtotal colectomies vs IPAA surgery (mean [SEM], 4.3 [0.8] vs 6.6 [0.4] days, respectively; $P = .01$) but similar total lengths of stay when all procedures (subsequent proctectomy and ileostomy takedown) were combined (mean [SEM], 11.9 [1.3] vs 10.6 [0.6] days, respectively; $P = .38$). The total number of readmissions within 30 days of surgery was similar between the 3-stage vs 2-stage groups (mean [SEM], 0.71 [0.15] vs 0.52 [0.07] readmissions, respectively; $P = .23$), although the number of readmissions per procedure was lower in the 3-stage group than in the 2-stage group (mean [SEM], 0.18 [0.09] vs 0.40 [0.05] readmissions, respectively; $P = .04$).

On univariate analysis, 2-stage procedures were associated with more perioperative complications following the first procedure (including abdominal sepsis, other infections [pneumonia, urinary tract infection, wound infection, line infection], thrombotic complications, and ileus or small-bowel obstruction) than 3-stage procedures (mean [SEM], 0.89 [0.09] vs 0.50 [0.18] complications, respectively; $P = .05$) but a similar number of perioperative complications overall (mean [SEM], 1.18 [0.13] vs 1.29 [0.26] complications, respectively; $P = .71$) (**Table 2**). Multivariate regression controlling for a priori variables (see Statistical Analysis) suggested that overall perioperative complications were affected by surgeon experience (mean [SEM], 1.16 [0.31] complications with high-volume surgeons vs 2.01 [0.46] complications with low-volume surgeons; $P = .02$) rather than creation of IPAA at the first operation (mean [SEM], 1.58 [0.35] complications for 2-stage procedures vs 1.80 [0.40] complications for 3-stage procedures; $P = .55$) or other variables (**Table 3**). Importantly, 2-stage procedures did not change the risk of anastomotic leak when all operations were taken into account (odds ratio = 1.09; 95% CI, 0.05-8.07; $P = .94$). There were no perioperative deaths in either group.

When followed up in the long term (mean [SEM], 5.2 [0.2] years), logistic regression suggested that patients who under-

Table 3. Multivariate Regression Analysis of Factors Affecting Total Perioperative Complications After 3-Stage vs 2-Stage Ileal Pouch–Anal Anastomosis Procedures

Variable	Estimate (SEM)	*P* Value
3-stage vs 2-stage	0.22 (0.36)	.55
Emergent status	0.03 (0.25)	.90
Age-adjusted CCI	0.14 (0.27)	.60
Severe disease at first operation	0.01 (0.17)	.93
Steroid use	−0.06 (0.14)	.67
Anti-TNF agent use	0.07 (0.13)	.61
Other immunomodulator use[a]	0.20 (0.12)	.10
High-volume IBD surgeon	−0.43 (0.18)	.02
Surgery Apgar score	0.09 (0.28)	.75

Abbreviations: CCI, Charlson Comorbidity Index; IBD, inflammatory bowel disease; TNF, tumor necrosis factor.

[a] Includes methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine.

Table 4. Odds of Long-term Complications for 3-Stage vs 2-Stage Ileal Pouch–Anal Anastomosis Procedures[a]

Long-term Complication	OR (95% CI)	*P* Value
Nonsurgical ileus or SBO	0.06 (0.002-0.54)	.007
Anal stricture	8.21 (1.55-52.32)	.01
Fistula or abscess	1.79 (0.36-7.92)	.46
Pouch failure	7.63 (0.22-209.51)	.23

Abbreviations: OR, odds ratio; SBO, small-bowel obstruction.

[a] Long-term complications are those more than 30 days postoperatively.

went 2-stage procedures might have a lower risk of anal stricture (*P* = .01) but a higher risk of nonsurgical ileus or small-bowel obstruction (*P* = .007) compared with patients who underwent 3-stage procedures (**Table 4**). There were no significant differences in fistula or abscess formation (*P* = .46) or in pouch failure (*P* = .23) between groups (Table 4).

Factors Affecting Outcomes Following 2-Stage Procedures

For patients undergoing 2-stage procedures, multivariate regression suggested that the total number of postoperative complications was affected by surgeon experience (mean [SEM], 2.25 [0.59] complications with high-volume surgeons vs 3.41 [0.85] complications with low-volume surgeons; *P* = .05) and use of immunomodulators other than steroids or anti-TNF agents at the first operation (mean [SEM], 3.21 [0.72] complications with use vs 2.45 [0.68] complications with no use; *P* = .04). Emergent status, steroid use, and anti-TNF agent use did not significantly affect 2-stage outcomes (all *P* > .05) (**Table 5**).

Table 5. Multivariate Regression Analysis of Factors Affecting Overall 2-Stage Ileal Pouch–Anal Anastomosis Procedure Outcomes

Variable	Estimate (SEM)	*P* Value
Emergent status	0.004 (0.58)	.99
Age-adjusted CCI	0.22 (0.41)	.59
Severe disease at first operation	0.08 (0.27)	.76
Steroid use	0.06 (0.23)	.79
Anti-TNF agent use	−0.05 (0.20)	.84
Other immunomodulator use[a]	0.38 (0.18)	.04
High-volume IBD surgeon	−0.58 (0.29)	.05
Surgery Apgar score	0.45 (0.40)	.26
Follow-up, y	0.24 (0.39)	.54

Abbreviations: CCI, Charlson Comorbidity Index; IBD, inflammatory bowel disease; TNF, tumor necrosis factor.

[a] Includes methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine.

Discussion

The decision to perform a 3-stage vs 2-stage procedure for a patient with severe UC is frequently driven by the surgeon's "gut instinct" and individual surgical upbringing with respect to dogma, preconceptions of risk, and previous patient experiences garnered from prior training and prior complications.[10] The reason for this unscientific approach is that there is no accepted standard of care and limited data are available to indicate the factors that would allow optimal, data-driven staging for IPAA surgery among patients with aUC in the midst of an acute disease flare. The objectives of this study were 2-fold: (1) to determine the predictors of a patient with aUC (ie, failing medical management) having a 3-stage IPAA procedure; and (2) to determine whether a 3-stage vs 2-stage procedure improves perioperative and long-term outcomes after taking these predictors into account. The results presented here suggest that, at our institution, most patients presenting with severe UC were treated with a 2-stage approach. The use of steroids or anti-TNF agents and the presence of medical comorbidities did not prevent our surgeons from constructing an IPAA at the index procedure, and postoperative outcomes were not adversely affected as a result of this approach. The 19.4% of patients who were treated with a 3-stage procedure were those who underwent surgery emergently and who had higher Charlson Comorbidity Index scores.

The high prevalence of a 2-stage approach that we report is different from the more conservative approaches used at other institutions, where a 3-stage approach is generally used for IPAA in patients with UC who are receiving long-term or high-dose steroids, patients with severe colonic disease, or patients undergoing emergent surgery.[7,10] However, this practice of shuttling acutely ill patients toward a 3-stage approach is largely based on a limited number of studies demonstrating that steroid use and severe proctitis may increase the risk of pelvic sepsis following IPAA,[8,9] combined with observations that pelvic sepsis was less frequent following 3-stage procedures.[16,17] Moreover, the latter studies were based on univariate analyses of data collected more than 20 years ago.

Interestingly, in this study we found that patients receiving treatment with nonstandard immunomodulators (ie, methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine) actually had lower odds of undergoing a 3-stage procedure. One possible explanation for this finding is that these second-line agents were more apt to be tried prior to surgery among patients failing medical management but without emergent complications of their disease. It is also possible that the

propensity to perform a 2-stage procedure with other immunomodulators is a reflection of the current lack of data on whether these agents increase the risk of pelvic sepsis. Of note, use of methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine was also associated with higher odds of perioperative complications in this study. Whether this was a reflection of the aggressive staging of patients receiving this treatment or an effect of the agents on the friability of the anastomosis itself remains to be determined. The impact of second-line immunomodulating agents on postoperative outcomes, and specifically anastomotic leak rates, may deserve more focused examination in the future.

More recent data that account for potential confounding variables suggest no difference in the frequency of pelvic sepsis with 2-stage vs 3-stage IPAA procedures as well as no overall difference in postoperative outcomes.[8,9,17-20] Consistent with this notion, we found that our patients who underwent 2-stage procedures did just as well in the short and long term as the patients who were initially treated with a subtotal colectomy. Furthermore, we found that outcomes following a 2-stage procedure were mostly affected by surgeon experience and the use of other immunomodulators (ie, methotrexate, 6-mercaptopurine, azathioprine, and cyclosporine) rather than by emergent status or the widely assumed predictors for complications such as steroid use, anti-TNF agent use, and disease severity.[8,9,21-24] Our patients who underwent 2-stage procedures also appeared to have a lower risk of anal stricture and no difference in the risk of fistula or abscess formation or in pouch failure in the long term compared with patients undergoing the "safer" 3-stage procedure.

Ultimately, our most interesting and thought-provoking finding is that, in addition to the use of other immunomodulators, surgeon experience played a significant role in determining patient outcomes after IPAA surgery. Having the procedure performed by a high-volume inflammatory bowel disease surgeon significantly decreased the incidence of postoperative complications both in our analysis of patients undergoing 3-stage vs 2-stage procedures and within the patients undergoing 2-stage procedures alone. This finding is consistent with previous data demonstrating that the incidence of postoperative pelvic sepsis decreases significantly with increasing surgical experience.[25] Pouch failure rates also appear to be higher during the initial learning curve phase of surgical practice.[26] The association between postoperative complications and lack of surgeon experience suggests that surgeons without formal colorectal training and with minimal inflammatory bowel disease experience should consider a delayed IPAA approach in an effort to mitigate the potential morbidity of the more aggressive 2-stage approach.

The decision about whether to perform an IPAA in 2 stages vs 3 stages not only has important implications for postoperative outcomes, but also affects overall treatment costs.[10,20,27,28] Patients with 2-stage procedures had similar total in-hospital lengths of stay and readmissions within 30 days in our study, but that does not mean that the overall treatment costs were equivalent. Swenson et al[20] reported a total cost savings of more than $10 000 for a 2-stage IPAA procedure compared with a 3-stage IPAA procedure, despite the fact that overall length of stay was not significantly different between the groups. Given the costs of operating room time, equipment, anesthetic agents, and personnel that are associated with each surgical procedure, this finding is not surprising. This is an important consideration in this era of health care reform, where the future of cost reimbursements is uncertain and medical institutions across the country are attempting to maximize the efficiency of care.

The limitations of our study deserve some discussion. This was a retrospective analysis performed on IPAA data from a single institution, raising the potential for biased or nongeneralizable results. There are likely a number of factors that contribute to the decision to perform a 2-stage vs 3-stage procedure that we were unable to measure because the data were not available and/or they are difficult to quantify. Only 28 of 144 patients underwent a 3-stage procedure, so it is possible that the study did not have sufficient statistical power to detect differences between groups. Ten different surgeons were included in the study, making it difficult to control for the use of different operative techniques (eg, rectal eversion technique, hand-sewn vs stapled anastomoses, cuff length, etc). However, one of the current problems with optimizing the operative management of UC is that most studies are based out of institutions with significant colorectal surgery expertise and/or are based on the experiences of a single surgeon. The conclusions of these studies are thus difficult to apply to the field in general. By including data from a variety of surgeons with a range of expertise, our results are potentially applicable to a broader audience. Finally, greater detail on precise dosing and timing of immunomodulatory treatment may have been enlightening in assessing the true effects of this therapy on anastomotic healing and should be the subject of future investigations.

In conclusion, patients with aUC undergoing immediate IPAA creation (ie, a 2-stage procedure) appear to have outcomes similar to those of patients who are initially treated with subtotal colectomy. Our data suggest that steroid use and anti-TNF agents alone do not justify the decision to avoid IPAA creation at the first operation, as long as the procedure is performed by a high-volume inflammatory bowel disease surgeon.

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Analysis and interpretation of data: All authors.
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