



## Original article

# An NSQIP evaluation of practice patterns and outcomes following surgery for anorectal abscess and fistula in patients with and without Crohn's disease

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**Background:** Patients with Crohn's disease (CD) are believed to have more aggressive anorectal abscess and fistula disease. We assessed the types of procedures performed and perioperative complications associated with the surgical management of anorectal abscess and fistula disease in patients with and without CD.

**Methods:** The American College of Surgeons National Surgical Quality Improvement Program database (ACS-NSQIP, 2005-2010) was used to calculate 30-day outcomes using regression modeling, accounting for demographics, comorbidities and surgical procedures. ICD-9 codes for anorectal abscess or fistula were used for initial selection. Patients were then stratified, based on the presence or absence of underlying CD. Local procedures included incision and drainage of abscesses, fistulotomy and seton placement. Cutaneous fistulas were considered simple, while all others were classified as complex (-vaginal, -urethral and -vesical).

**Results:** A total of 7,218 patients (mean age 45 years; 64% male) met inclusion criteria, with underlying CD in 345 (4.8%). CD patients were more likely to have a seton placed (9.9 vs 8.2%,  $P < 0.001$ ) and be on steroids (15.4 vs 4.3%,  $P < 0.001$ ). Thirty-seven percent of CD patients underwent local procedures, while 46% had a proctectomy and 8% underwent diversion. Fistulotomy was more common in those without underlying CD (16 vs 11%,  $P < 0.001$ ). The overall complication rate after local treatment was 4.9%, with no difference between patients with and without CD (7.7 vs 4.9%,  $P = 0.144$ ). This was not affected by fistula type—simple (7.9 vs 3.9%,  $P = 0.194$ ) vs complex (33 vs 7.1%,  $P = 0.21$ )—or when stratified by wound (3.8 vs 2.4%;  $P = 0.26$ ) or systemic complications (3.8 vs 2.5%;  $P = 0.53$ ). Yet, complications following emergency procedures were higher in patients with CD (21.4 vs 5.9%,  $P = 0.047$ ). Factors significantly associated with increased complications were Crohn's disease (OR = 8.2), lack of functional independence (OR = 2.0), pre-operative weight loss (OR = 2.6) and pre-operative acute renal failure (OR = 5.6). Steroids were also associated with a 1.7-fold increase in complications, independent from CD.

**Conclusions:** While most patients with anorectal abscess/fistula are treated with local procedures, proctectomy and diversion use is fairly common in those with underlying CD. Although complication rates following elective local procedures for anorectal abscess/fistula are similar in patients with and without CD, they are higher in patients on steroids and in CD patients undergoing emergent procedures.

**Keywords:** National Surgical Quality Improvement Program (NSQIP); Crohn's disease; anorectal diseases; anorectal abscess; fistula-in-ano.

## INTRODUCTION

Anorectal abscess with or without fistula is a common source of patient discomfort. Patients are often reluctant to seek medical care and their primary care providers (and even some surgeons) are traditionally unfamiliar with nuances of their disease management [1]. The treatment algorithm for anorectal disease is further complicated in patients with Crohn's disease (CD). Factors such as chronic immunosuppression, loose stools and recurrent disease add to the potential morbidity of asurgical intervention. In addition, the potential of poor wound healing and prolonged hospitalization frequently leads to a specialty surgeon referral. Therefore, defining the involved perianal anatomy and extent of pathology are fundamentally important to optimize outcomes. Despite adequate therapy, severe perianal disease has been associated with fecal diversion rates in up to 40–80% of Crohn's patients [2, 3].

The decision to operate on CD patients with perianal disease needs to be highly individualized. Patients with asymptomatic fistulas demonstrating no signs of local sepsis or surgical abscess require medical therapy and not surgical intervention. In fact, medical therapy alone has reported fistula healing rates in up to 46% of CD patients [4], resulting in practice patterns of surgical intervention only after a period of immunosuppression therapy. This must be balanced with an 8–13% incidence of fecal incontinence with repetitive perianal sepsis, underlying the need for timely and appropriate intervention [5, 6]. The primary purpose of our study was to analyse the types of procedures performed on CD patients and the difference in patient demographics, operative time/hospitalization and post-operative outcomes when surgical therapy is undertaken in the management of anorectal abscess and fistula in comparison to the general population.

## METHODS

The American College of Surgeons National Surgical Quality Improvement Program database (ACS-NSQIP, 2005-2010) was used to calculate risk-adjusted 30-day outcomes following surgical therapy for anorectal CD using regression modeling, accounting for patient demographics, co-morbidities and surgical procedures. The ACS-NSQIP database gathers information on healthcare quality through a compilation of pre-operative risk factors, intra-operative factors and post-operative 30-day morbidity and mortality in patients who undergo major surgical procedures [7]. A dedicated surgical clinical nurse reviewer (SCNR) at each site collects the data for both inpatients and outpatients for 30 days post-operatively on 21 defined complications. Data in the ACS-NSQIP database is de-identified to ensure no patient identifiable factors. The Madigan Healthcare System Institutional Review

Board approved this study. Specific details of the data collection, inclusion and exclusion criteria, training of the actuaries and the method of random sampling are described by the ACS-NSQIP [8].

Patients were initially identified using CPT codes for severe Crohn's disease requiring proctectomy (CPT codes 45110, 45111, 45112, 45114, 45119 and 45123), inadvertent CD thought to be ulcerative colitis (CPT code 45136), severe Crohn's disease requiring diversion (CPT code 44320), as well as anorectal abscess (CPT codes 45000, 45005, 45020, 46040 and 46045), major fistula (CPT codes 45800, 45820, 46030, 57305 and 57308), local fistula (CPT codes 46060 and 46706) and fistula requiring a seton (CPT code 46020). ICD-9 code inclusion criteria was used to identify Crohn's disease, abscess of anal and rectal regions, anal fistula, cellulitis abscess of buttock and digestive–genital tract fistula in female. Both emergency and elective cases were included in this study. Patients were then stratified, based on the presence or absence of underlying CD (ICD-9 555.xx). Local procedures were defined as incision and drainage of abscesses, fistulotomy and seton placement. Cutaneous fistulas were considered simple, while all others were classified as complex (i.e. -vaginal, -urethral and -vesical). While the Crohn's Disease activity index is the best indicator for extent of infection, this is not available in NSQIP; therefore we utilized CPT codes specific for Crohn's disease as a surrogate.

Statistical analysis was performed using PASW Version 19.0 (SPSS, Chicago, IL, USA). Categorical variables are represented as rates and continuous variables as mean  $\pm$  standard deviation. Categorical variables were analysed using chi-squared analysis and continuous variables using Student's *t*-tests. Pre-operative comorbidities, physiological data and surgical therapy were entered into multivariate logistic regression analysis *a priori*. Statistical significance was reported on the multivariate model using a 95% confidence interval with an alpha level set at 0.05.

## RESULTS

A total of 7,218 patients (mean age  $45.1 \pm 14.8$  years; 64% male) met inclusion criteria for this study. The population with Crohn's disease was five years younger and evenly divided between males and females (Table 1). There were 345 (4.8%) patients who had underlying Crohn's disease. When looking specifically at the CD patients, they were more likely to have a seton placed (9.9 vs 8.2%,  $P < 0.001$ ) and take steroids prior to their operation (15.4 vs 4.3%,  $P < 0.001$ ). When assessing the types of procedures performed on CD patients, 37% underwent local procedures, while 46% had a proctectomy and 8% underwent diversion. Fistulotomy was more common in the general

**Table 1.** Demographic breakdown of the types of procedures performed, stratified by Crohn's Disease vs No Crohn's disease

Comorbidity	No Crohn's	Crohn's	Overall	P-value
Age (years)	45.3 ± 14.8	40.6 ± 13.8	45.1 ± 14.8	<0.001
Male	4449 (64.7)	171 (49.5)	4620 (64)	<0.001
American Indian or Alaska Nat.	0.5%	0.0%	0.5%	
Asian	2.8%	0.8%	2.7%	
Black or African American	17.7%	8.1%	17.3%	
Hispanic, Black	2.5%	0.2%	2.4%	
Unknown	10.6%	5.7%	10.5%	
White	64.6%	83.7%	65.5%	<0.001
Diabetes	970 (14.1%)	12 (3.4%)	982 (13.6%)	<0.001
Dyspnea	305 (4.4%)	19 (5.5%)	324 (4.4%)	0.34
Functionally independent	6594 (95.9%)	335 (97.1%)	6929 (95.9%)	0.28
Prior operation within 30 days	557 (8.1%)	48 (13.9%)	605 (8.3%)	<0.001
Systemic sepsis within 48 hours prior to surgery	2128 (30.9%)	19 (5.5%)	2147 (29.7%)	<0.001
Current smoker within one year	2358 (34.3%)	94 (27.2%)	2452 (33.9%)	<0.001
ETOH >2 drinks per day in the two weeks prior to admission	281 (4%)	7 (2%)	288 (3.9%)	0.05
History of severe COPD	151 (2.1%)	1 (0.2%)	152 (2.1%)	0.01
Recently diagnosed PNA	17 (0.2%)	0 (0%)	17 (0.2%)	0.35
Congestive heart failure within 30 days prior to surgery	29 (0.4%)	2 (0.5%)	31 (0.4%)	0.66
Has undergone percutaneous coronary intervention (PCI) at any time (including any attempted PCI)	180 (2.6%)	2 (0.5%)	182 (2.5%)	0.01
Hypertension requiring medication	1972 (28.6%)	45 (13%)	2017 (27.9%)	2.6
Acute renal failure should be noted within 24 hours prior to surgery	32 (0.4%)	1 (0.2%)	33 (0.4%)	0.63
Currently requiring or on dialysis	94 (1.3%)	0 (0%)	94 (1.3%)	0.02
Impaired sensorium patient is acutely confused and/or delirious and responds to verbal and/or mild tactile stimulation.	34 (0.4%)	0 (0%)	34 (0.4%)	0.19
Oral or parenteral steroid use for a Chronic condition	294 (4.2%)	67 (19.4%)	361 (5%)	<0.001
>10% loss of body weight in the 6 months prior to surgery	101 (1.4%)	20 (5.7%)	121 (1.6%)	<0.001
Bleeding disorders	301 (4.3%)	7 (2%)	308 (4.2%)	0.03
Transfusions >4 units of PRBCs/whole blood within 72 hours prior to surgery	10 (0.1%)	2 (0.5%)	12 (0.1%)	0.05

ETOH=alcohol, COPD=chronic obstructive pulmonary disease, PNA=pneumonia, PRBC=packed red blood cells.

population than in those who had underlying CD (16 vs 11%,  $P < 0.001$ ).

### Procedural outcomes

There was a 4.9% complication rate (Table 2) after local treatment and this was not different in those patients who had Crohn's disease, compared to the general population (7.7 vs 4.9%,  $P=0.144$ ). This difference was also not affected by fistula type, whether it was simple (7.9 vs 3.9%,  $P=0.194$ ) versus complex (33 vs 7.1%,  $P=0.21$ ), or when stratified by wound (3.8 vs 2.4%;  $P=0.26$ ) or systemic complications (3.8 vs 2.5%;  $P=0.53$ ). When analysing those patients who were operated on emergently, complication rates were higher in those patients with pre-existing CD

(21.4 vs 5.9%,  $P=0.047$ ). Crohn's disease patients were also more likely to have superficial surgical site infections, wound disruptions, urinary tract infections, post-operative blood transfusions and to develop systemic sepsis; however, the rate of septic shock was not different in this group (Table 3). On multivariate analysis, pre-operative factors found to increase the risk of post-operative complications were underlying Crohn's disease, pre-operative acute renal failure, pre-operative transfusions, current chemotherapy, functional dependence, pre-existing septic state and corticosteroid use (Table 4). On the other hand, higher albumin levels were found to be protective, with increased levels associated with lower rates of post-operative complications.

**Table 2.** Demographics of the study population, stratified by the population with Crohn's disease

Complication	No Crohn's	Crohn's	Overall	P-value
Overall complication rate	336 (4.8%)	84 (24.3%)	420 (5.8%)	<0.001
Superficial incisional SSI	80 (1.1%)	36 (10.4%)	116 (1.6%)	<0.001
Deep incisional SSI	49 (0.7%)	10 (2.8%)	59 (0.8%)	<0.001
Organ/space SSI	25 (0.3%)	16 (4.6%)	41 (0.5%)	<0.001
Wound disruption	12 (0.1%)	4 (1.1%)	16 (0.2%)	<0.001
Progressive renal insufficiency (no dialysis)	16 (0.2%)	2 (0.5%)	18 (0.2%)	0.2
Acute renal failure requiring dialysis	9 (0.1%)	0 (0%)	9 (0.1%)	0.5
Urinary tract infection	27 (0.3%)	15 (4.3%)	42 (0.5%)	<0.001
Myocardial infarction	9 (0.1%)	0 (0%)	9 (0.1%)	0.5
Bleeding requiring >4 units PRBCs or whole blood transfusions within the first 72 hours after surgery	19 (0.2%)	8 (2.3%)	27 (0.3%)	<0.001
Deep vein thrombosis (DVT)/requiring therapy	15 (0.2%)	1 (0.2%)	16 (0.2%)	0.78
Systemic sepsis	79 (1.1%)	23 (6.6%)	102 (1.4%)	<0.001
Severe sepsis/septic shock	27 (0.3%)	3 (0.8%)	30 (0.4%)	0.17
Pre-operative WBC ( $\times 10^9$ )	11.9 $\pm$ 5.3	8.9 $\pm$ 3.3	11.7 $\pm$ 5.3	<0.001
Pre-operative albumin (g/L)	35.6 $\pm$ 7.3	36.7 $\pm$ 7.8	35.7 $\pm$ 7.3	0.066
Operative time (min)	23.7 $\pm$ 25.1	133.0 $\pm$ 111.0	29.0 $\pm$ 41.7	<0.001
Hospital stay (d)	3.87 $\pm$ 6.39	7.54 $\pm$ 6.97	4.09 $\pm$ 6.48	<0.001
Length of total surgical stay (d)	3.60 $\pm$ 6.11	7.63 $\pm$ 7.08	3.84 $\pm$ 6.25	<0.001
Surgical admission to operation (d)	1.86 $\pm$ 3.20	3.7 $\pm$ 5.16	1.94 $\pm$ 3.32	<0.001

SSI=surgical site infection, PRBC=packed red blood cells, WBC=white blood cell, d=days.

**Table 3.** Complications in the study population, stratified by Crohn's disease

Variable	OR (95% CI)	P-value
Crohn's disease	8.2 (5.4–12.0)	<0.001
Pre-operative acute renal failure	5.6 (2.4–13.0)	<0.001
Pre-operative transfusion	3.9 (0.9–15.0)	0.053
Chemotherapy	2.2 (1.1–4.1)	0.014
Functionally dependent	2.0 (1.3–3.1)	0.001
Septic	1.8 (1.3–2.5)	<0.001
Corticosteroids	1.7 (1.1–2.6)	0.005
Increasing pre-operative albumin level	0.6 (0.5–0.7)	<0.001

**Table 4.** Multivariable analysis of risk factors for increased complications

Type of procedure	No Crohn's disease		Crohn's disease	
	(n=6873; 95.2%)		(n=345; 4.8%)*	
Proctectomy	77	1%	159	46%
Diversion	153	2%	29	8%
Abscess	4761	69%	60	17%
Fistula (major)	203	3%	3	1%
Fistula local	1116	16%	41	12%
Fistula seton	563	8%	37	11%

\*Percentage does not equal 100 as 15 patients (5%) had inadvertent Crohn's disease thought to be UC and were not included in the table.

## DISCUSSION

This study confirms that the treatment of perianal disease is very difficult in patients with underlying CD. The nearly five-fold increased rate in overall complications (24 vs 4.9%) in CD patients serves as a reminder for surgeons caring for this cohort presenting emergently to proceed with caution, as their surgical management is inherently potentially more difficult. This study further demonstrates that more than 50% of patients with underlying Crohn's

disease were managed with methods that resulted in either temporary or permanent fecal diversion. While this is in line with prior studies demonstrating diversion rates from 31–49% in those with complex perianal CD [9], it underscores the degree of oft-times recalcitrant pathology in these patients. Moreover, these rates are significantly increased when there is concomitant colonic disease, anal sepsis, fecal incontinence, or any evidence of anal canal stenosis [10].

Additionally, our study demonstrated that, in comparison to the general population, these patients tend to be younger, female and are more likely to have had a recent operation. As recurrence rates will increase over time for CD patients, local therapy is often beneficial (when able) to temporize patients who present with complex disease and make every effort to initiate maximal medical therapy. Proctectomy tends to be reserved for those whose disease is uncontrollable through local measures, or those that fail to have a robust response to medical therapy. Very often, proctectomy is only performed after the patient has “had enough” of their disease—something we were unable to determine from this type of study.

Not surprising, operative times were significantly higher in patients with Crohn’s disease and their length of stay was longer. Time from surgical admission to operation was also significantly greater in the patients with Crohn’s, implying either a delay in surgical consultation or that surgeons are more likely to attempt medical therapy prior to undertaking surgical intervention in this subgroup of patients. This is an important finding that also mimics recent consensus guidelines, as well as single center studies recommending that patients with CD should undergo a period of medical therapy prior to surgical intervention [11]. One limitation of this analysis, however, is that patients who had successful treatment using medical therapy alone would not be included within this study, as the NSQIP database only includes operative treatment. However, it does highlight the general shift in treatment strategy with these patients. We also found that Crohn’s disease patients are more likely to have had a seton placed, mirroring the findings of other studies demonstrating that fistulas may be controlled effectively with long-term seton placement to control drainage, prevent recurrent sepsis and allow inflammation to resolve [12].

In evaluating the specific complication rate profiles, the difference between the two cohorts was predominately in surgical site infections and wound disruptions. Despite similar albumin levels, the aforementioned increase in steroid use and inherent healing difficulties with CD may account for these differences. Also noted were the increased rates of urinary tract infections and systemic sepsis in CD patients, despite similar rates of life-threatening infections. Post-operative transfusion rates within the first 72 hours following surgery were also higher in CD patients, which could be viewed as either a surrogate for post-operative hemorrhage or pre-existing anemia. Aside from Crohn’s disease itself, other pre-operative factors including acute renal failure, pre-operative transfusions, chemotherapy, a lack of functional independence and a septic presentation may trigger surgeons to modify their intervention [13, 14]. Regardless, the high complication rates seen with surgical management should be a part of the

pre-operative discussion with individuals requiring this method of treatment.

The study does have several distinct limitations that are almost always present in large database studies. First, the overall population size in some of the post-operative complications, such as septic shock, was not large enough to determine a difference when one may have been present. Additionally, the retrospective nature of the analysis, as well as the confines of the actual demographic variables, makes widespread interpretation occasionally difficult. There is no way to determine exactly which patients were on other types of immunosuppressive therapy, the extensive nature of their Crohn’s disease or whether or not they had had multiple operations previously secondary to Crohn’s disease itself. There is also no specific fistula classification, by CPT code or NSQIP defined variable, that helps to delineate more complex fistulas (i.e. a horseshoe abscess or supra/intersphincteric from a patient with Crohn’s disease and a low lying fistula, with no active proctitis). Despite these limitations, advantages of this type of study are in the large population sample and the extensive number of pre-operative and post-operative variables that are recorded within the study. Additionally, based on the multiple CPT listings as well as the ICD-9 diagnoses, we were able to stratify Crohn’s disease outcomes and compare those with the general population on a level that would not be possible at single center or even multi-center studies.

## CONCLUSION

While most patients with anorectal abscess/fistula are treated with local procedures, a requirement for proctectomy and diversion is still fairly common in those with underlying CD. The higher rates of overall complications with CD patients serve as a reminder to surgeons to avoid aggressive operative intervention when not appropriate, as well as the need for proper pre-operative counseling for patients requiring surgical therapy.

## DISCLAIMERS

- (1) The investigators have adhered to the policies for protection of human subjects as prescribed in 45 CFR 46.
- (2) The views expressed are those of the author(s) and do not reflect the official policy of the Department of the Army, the Department of Defense or the U.S. Government.
- (3) This paper has been approved by the Madigan Army Medical Center Human Use Institutional Review Board.
- (4) The ACS-NSQIP and the hospitals participating in the ACS-NSQIP are the source of the data used herein;

they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

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