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Yield of Post-Acute Diverticulitis Colonoscopy for Ruling Out Colorectal Cancer

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Abstract

Background and Aims—Colonoscopy is recommended post-acute diverticulitis (AD) to exclude underlying adenocarcinoma (CRC). However, post-AD colonoscopy utility remains controversial. We aimed to examine yield of post-AD colonoscopy in our majority-Hispanic patient population.

Methods—Patients undergoing post-AD colonoscopy between 11/1/2015–7/31/2021 were identified from a prospectively maintained endoscopic database. AD cases without computed tomography confirmation were excluded. Pertinent data, including complicated vs uncomplicated AD, fecal immunochemical test (FIT) result post-AD/pre-colonoscopy, and number/type/location of non-advanced adenomas, advanced adenomas, and CRC, were abstracted. Analyses were conducted using two-sample Wilcoxon rank-sum and Fisher's exact tests.

Results—208 patients were included, of whom 62.0% had uncomplicated AD. Median age was 53, 54.3% were female, and 77.4% were Hispanic. Ninety non-advanced adenomas were detected in 45 patients (21.6%), in addition to advanced adenoma in eight patients (3.8%). Two patients

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(1.0%) had CRC, both of whom had complicated AD in the same location seen on imaging, and one of whom was FIT+ (the other had not undergone FIT). Patients with uncomplicated versus complicated AD had similarly low rates of advanced adenomas (4.7% vs. 2.5%, p=0.713). FIT data were available in 51 patients and positive in three (5.9%); non-advanced adenomas were found in all three FIT+ patients. No FIT- patient had an advanced adenoma or CRC.

Conclusion—Colonoscopy post-AD is generally low yield, with CRC being rare and found only in those with complicated AD. Colonoscopy post-complicated AD appears advisable, whereas less invasive testing (e.g. FIT) may be considered post-uncomplicated AD to inform the need for colonoscopy.

Keywords

colonoscopy; adenoma detection; adenocarcinoma; fecal immunochemical test (FIT); diverticular disease

INTRODUCTION

Approximately 200,000 individuals in the United States are hospitalized each year for acute diverticulitis (AD).[1] The risk for diverticular disease increases with age, and AD is most common in individuals older than the age of 50.[2–5] Unless a colonoscopy has been performed within the preceding year, it is recommended that patients undergo diagnostic colonoscopy 6–8 weeks after an episode of AD, regardless of the presence or absence of a) complicated AD and b) risk factors for colorectal adenocarcinoma (CRC).[2–5] The rationale for this practice is to exclude CRC mimicking the signs and symptoms of AD.[6,7] However, the utility of performing colonoscopy post-AD remains an understudied, controversial topic, and though its yield has not been widely examined, it is generally regarded as low based on prior studies.[2,7–13] Notably, the 2015 American Gastroenterology Association (AGA) Guidelines on the management of acute diverticulitis emphasized that the quantification of the yield, risks, and timing of post-AD colonoscopy should be a research priority.[3] More recently, the AGA has suggested that the decision to proceed with post-AD colonoscopy should take a more nuanced, multifactorial approach that takes into account disease severity, patient's past medical history, and most recent colonoscopy findings.[14]

Colonoscopy in the post-AD patient may carry an increased risk for perforation or other adverse events, especially if the AD is not resolved by the 6–8 week mark, e.g. if residual colonic inflammation and/or narrowing is present during colonoscopy.[15–18] Moreover, performing colonoscopy in every individual post-AD may not represent efficient utilization of a costly and limited resource. Indeed, the average annual cost of a single colonoscopy is roughly $1,150 per patient served,[19,20] and in many centers, the wait time for routine outpatient colonoscopy is on the order of weeks to months. Therefore, if it were to be demonstrated that the benefits to performing post-AD colonoscopy are low, this could justify a shift in clinical practices to selectively perform fewer low-yield post-AD colonoscopies, which may reduce patient exposure to unnecessary procedural risk, decrease healthcare costs, and increase access to timely colonoscopy for those in greatest need, especially now that the recommended age for CRC screening has been lowered to age 45.

Our study aim was to examine the yield of post-AD colonoscopy in ruling out CRC as well as for detecting advanced and non-advanced adenomas. We hypothesized that performing colonoscopy in the majority of patients post-AD is low yield, and that, concordant with AGA guidelines, certain features may help prioritize colonoscopy based on pre-procedure expected yield.

METHODS

Study setting and population

The study was conducted at Olive View-UCLA Medical Center (OVMC), a 377-bed safety net teaching hospital in the Los Angeles Department of Health Services (LADHS) system, offering care to the medically underserved. LADHS is the second largest municipal healthcare system in the country and has a predominantly Latino patient population.[21] Using a prospectively maintained electronically database, we retrospectively reviewed all colonoscopies performed from November 1, 2015 through July 31, 2021 in patients 18 years of age and older, with the indication of post-AD colonoscopy. Patients without computed tomography (CT) confirmation of AD (i.e. only a clinical diagnosis with antibiotics prescribed) were excluded. We also excluded a total of 23 patients who were either planned to undergo post-AD colonoscopy but who did not present to their appointment or who had not yet undergone planned post-AD colonoscopy at the time of submission of this manuscript. Patient demographics, personal and family medical history, radiographic findings, laboratory values, and colonoscopic data were abstracted.

Study outcome and variables

The primary study outcome was adenocarcinoma visualized during colonoscopy, while non-advanced adenomas and advanced adenomas (defined as >1cm, tubulovillous, villous, or high-grade dysplasia) were secondary outcomes. The study variables studied included age, sex, BMI, race/ethnicity, family history of malignancy and AD, personal history of malignancy and AD, uncomplicated or complicated AD (defined as AD with associated abscess, fistula, perforation, and/or stricture), type of AD complication, location of AD on CT; white blood cell (WBC) count, hemoglobin, mean corpuscular volume (MCV), absolute lymphocyte count, platelet count, iron saturation, and ferritin, upon hospital presentation; fecal immunochemical test (FIT) results post-AD/pre-colonoscopy; post-AD colonoscopy findings (total number, type, and location of non-advanced adenomas, total number and location of advanced adenomas, and total number and location of CRCs), whether advanced adenomas or CRC were visualized in the same location as AD on CT, and incidental colonoscopy findings (e.g. inflammatory bowel disease, ischemic colitis, segmental colitis associated with diverticulosis).

Statistical analyses

Two-sample Wilcoxon rank-sum tests and Fisher’s exact tests were used to compare demographic, laboratory, radiographic, and other pre-colonoscopy clinical parameters in patients with and without complicated AD, and separately in patients with and without a positive FIT. Statistical analyses were performed using Stata/IC 16.1 (StataCorp, College Station, TX, United States). A p-value <0.05 was considered statistically significant.

RESULTS

Sample characteristics

A total of 208 patients were included, of whom 77% were Hispanic, representative of the overall OVMC patient demographics (Table 1). The median age was 53 years, 54.3% were female, the median BMI was 30, and 29.3% had a history of smoking. A personal history of non-CRC cancer diagnosed before colonoscopy was present in 3.9% of patients, and 20.7% had a first degree relative with non-CRC cancer. Uncomplicated AD was present in 62.0% of patients, while 38.0% had complicated AD (Figure 1). Colonic abscess was diagnosed in 17.3% of patients, fistula in 7.2%, stricture in 1.9%, and perforation in 18.8%. Among those with complicated AD, 14 patients had more than one type of complication. Time from episode of AD to colonoscopy was variable: 10.6% had colonoscopy performed within 2 months post-AD, 46.6% between 2–6 months post-AD, 26.9% between 6–12 months post-AD, and 15.8% over 12 months post-AD.

Colonoscopy findings and outcomes

CRC was detected in 2/208 (1.0%) patients post-AD, with one patient being above and one being below age 45 (Table 2). A total of 90 non-advanced adenomas were found in 45 patients. Advanced adenomas were detected in 8 patients (3.9%), with 5 patients (2.4%) having tubulovillous adenomas, 2 patients with tubular adenomas >1 cm (1.0%), and 1 patient with sessile serrated adenoma >1 cm (0.5%). This yielded a total adenoma detection rate (ADR) of 25.5%. These and other colonoscopy findings and outcomes are presented in Table 2.

Among patients with adenomatous polyps present (including both advanced and non-advanced adenomas), 4.1% of polyps were in the cecum, 42.9% in the ascending colon, 15.3% in the transverse colon, 11.2% in the descending colon, 21.4% in the sigmoid colon, and 5.1% in the rectum. In both cases of CRC, the tumor was in the sigmoid colon and in the same region as diverticulitis seen on CT. Half (50%) of advanced adenomas visualized on colonoscopy were where diverticulitis was seen on CT.

Colonoscopy findings in age <45 vs ≥45 years—Given the new recommendation to begin CRC screening at 45 years of age, we compared the prevalence of CRC and adenomatous polyps in those below age 45 to those 45 and older. We observed 17 patients below age 45 who had uncomplicated AD, and of these, none had CRC, none had advanced adenomas, and three had non-advanced adenomas. Comparatively, 112 patients age ≥45 had uncomplicated AD, among whom none had CRC, six had advanced adenomas, and 30 had non-advanced adenomas. A total of 23 patients below age 45 had complicated AD, of whom one had CRC, none had advanced adenomas, and three had non-advanced adenomas. Complicated AD was observed in 46 patients age ≥45, of whom one had CRC, two had advanced adenomas, and nine had non-advanced adenomas. Thus, with the exception of one patient below age 45 who had complicated AD, none of the remaining 39 patients below age 45 had CRC or advanced adenomas.

Characteristics and outcomes stratified by uncomplicated vs complicated AD

Among patients with uncomplicated AD, 25.6% had non-advanced adenomas compared to 15.2% with complicated AD (p=0.169). There was no statistically significant difference in the presence of advanced adenomas between the two groups (6/129 in uncomplicated AD vs 2/79 in complicated AD, p=0.713). Of those with complicated AD, 68.4% (54/79) were male compared to 31.8% (41/129) of patients with uncomplicated AD (p<0.001). Both cases of CRC were observed in patients with complicated AD (2.5%), while no cases of CRC were observed in patients with uncomplicated AD (p=0.143). Additional data stratified by uncomplicated vs. complicated AD are shown in Table 3.

Characteristics and outcomes stratified by FIT result

Fifty-one patients had a FIT performed after AD and prior to colonoscopy, and 3 were positive. None of the FIT-negative patients had CRC, whereas CRC was present in 1/3 (33.3%) of the FIT-positive patients (p=0.059). All three FIT-positive patients had non-advanced adenomas on colonoscopy compared to 12/48 (25%) in the FIT-negative group (p=0.022). None of the FIT-negative patients had non-CRC advanced adenoma. Additional data stratified by FIT result are shown in Table 4.

DISCUSSION

The primary rationale for performing post-AD diagnostic colonoscopy is to exclude underlying CRC mimicking AD.[22] Though there is a paucity of robust literature on the benefit of post-AD colonoscopy, particularly in minority populations, previous investigations and anecdotal data have suggested that the yield is generally low.[23–26] In our study, the main findings were that: i) of the 208 patients in total, 129 had uncomplicated AD, of whom none had CRC; ii) of the remaining 79 patients with complicated AD, only 2 had CRC; iii) of the two patients with CRC, one was over 45 years old and FIT-positive, which would have independently led to diagnostic colonoscopy; iv) a greater-than-expected prevalence of non-advanced adenomas post-AD was not observed; v) there was a statistically significant increased risk of encountering a non-advanced adenoma in patients who were FIT-positive post-AD/pre-colonoscopy vs those who were FIT-negative, demonstrating the utility of FIT in patients who are post-AD.

At our institution, annual FIT is utilized to screen for CRC, with FIT-positive patients being referred for colonoscopy. In this setting, colonoscopy has diagnoses CRC in 2.6% of our reference population, which is higher than our observed prevalence of 1.0% post-AD (and 0% post-uncomplicated AD). Moreover, our findings are generally in line with previous reports and expand current understanding of post-AD colonoscopy yield. With regards to the primary outcome, prior studies have reported a comparably low prevalence of CRC (0.3–1.9%) post-AD, similar to our observed prevalence of 1.0%.[23–26] Regarding advanced adenomas, previous studies have also reported a low prevalence post-AD,[24,26] similar to our observed prevalence of 3.9%. Importantly, existing data suggest that the risk of CRC after uncomplicated AD is low, though it increases with cases of complicated AD.[2] Concordant with these data, the only observed cases of CRC in our cohort (2/208) occurred in patients with complicated diverticulitis.

As a point of reference, at our institution, the ADR for patients referred for colonoscopy following a positive FIT result is 55.2%, which is considerably higher than the 25.5% ADR observed in this study of post-AD patients. Notably, FIT had a 100% negative predictive value for CRC and advanced adenomas in our study. Thus, given the generally low yield of colonoscopy in post-AD patients, the associated costs and risks, and the complementary role of FIT, it may be reasonable to risk-stratify patients rather than indiscriminately performing colonoscopy in all cases of AD, especially in healthcare settings, such as our safety net county medical center, where screening colonoscopy is not readily available. As shown in Figure 2, we would propose, especially in centers where FIT is the primary CRC screening modality, a shift in practice paradigms so that only patients with CT-confirmed *complicated* AD (or other features that make them higher risk for CRC) proceed to colonoscopy after resolution of AD. On the other hand, patients with post-CT-confirmed *uncomplicated* AD may proceed to FIT (or potentially other non-invasive testing) after resolution of AD. In settings where colonoscopy *is* available as a first-line CRC screening test, it is reasonable to proceed with colonoscopy in patients with uncomplicated AD who are due for CRC screening; conversely, patients with uncomplicated AD who are not due for CRC screening (e.g. age <45) or who prefer to avoid colonoscopy may proceed with non-invasive testing (e.g. FIT).

Our study possesses unique strengths. First, it reports the clinical profile of a minority-predominant, vulnerable patient population not previously studied in the setting of post-AD colonoscopy yield. Second, in studying this patient population. we are examining the individuals arguably most affected by inappropriate allocation of healthcare resources, both as it relates to their access to timely care (including colonoscopies) and in their ability to take leave from work or find access to childcare and transportation. While outside of the scope of the current study, we recognize the importance of future research on the social determinants of health, including how racism and healthcare inequities impact patient care across all fields of medicine.[27,28] Medical research should not only have a vital role in understanding and mitigating disparities among different patient populations, but we must be vigilant not to contribute to worsening existing disparities between privileged and disadvantaged groups.[27,28] Lastly, our study uniquely accounted for FIT result before post-AD colonoscopy, which does not appear to have been attempted in prior studies in the setting of AD; FIT may augment further risk stratification, especially in settings where colonoscopy is not a primary CRC screening modality or in patients who prefer to avoid colonoscopy.

Conversely, we also acknowledge certain limitations. This was a single-center retrospective study, and although the sample size was comparable to that of other published studies on post-AD colonoscopy yield, a larger sample size would increase statistical power and enable the performance of different statistical analysis methods. For example, the sample size of 45 patients with non-advanced adenomas, eight with advanced adenomas, and two with CRC did not allow us to conduct meaningful regression modeling to identify predictors for these outcomes. In addition, while FIT is readily available at our facility, only 51/208 patients underwent FIT before post-AD colonoscopy. Of these 51, only 3 were FIT-positive, making it difficult to find differences between the FIT-positive and FIT-negative patients. However, despite this, all 48 patients that were FIT-negative had no instance of CRC or

advanced adenoma. Finally, the study population was largely underserved and majority Hispanic/Latino, which may limit the applicability of this study in other populations.

In summary, our findings indicate that post-AD colonoscopy has a low yield in detecting CRC or advanced adenomas. In addition, we found that type of AD (uncomplicated vs complicated), FIT status (negative vs positive), and age (<45 vs ≥45 years) all have predictive value. Thus, indiscriminate performance of colonoscopy may not be necessary in all patients post-AD, especially in those who have uncomplicated AD, are up to date with CRC screening (including annual FIT), and are age <45. Therefore, the approach proposed in Figure 2 may instead be considered; in brief, whereas complicated AD constitutes an indication to perform diagnostic colonoscopy, uncomplicated AD may be viewed as an indication to perform/initiate CRC screening, for which noninvasive options can be considered in order to minimize low-yield post-AD colonoscopies. This would in turn lead to savings for the healthcare system, benefit patients by reducing exposure to procedural risks, and help allocate medical resources and gastroenterologist time capital more efficiently.

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WHAT YOU NEED TO KNOW

Background:

Post-acute diverticulitis (AD) colonoscopy utility is unclear but suspected to be low-yield for identifying colorectal cancer (CRC).

Findings:

Post-AD colonoscopy had low yield (1.0%) in detecting CRC or advanced adenomas in our predominantly Latino patient population. Both observed cases of CRC were in patients with *complicated* AD.

Implications for Patient Care:

Indiscriminate post-AD colonoscopy may be unnecessary and a costly utilization of resources. Diagnostic colonoscopy is indicated post-complicated AD cases, while uncomplicated AD cases may first undergo less-invasive testing.

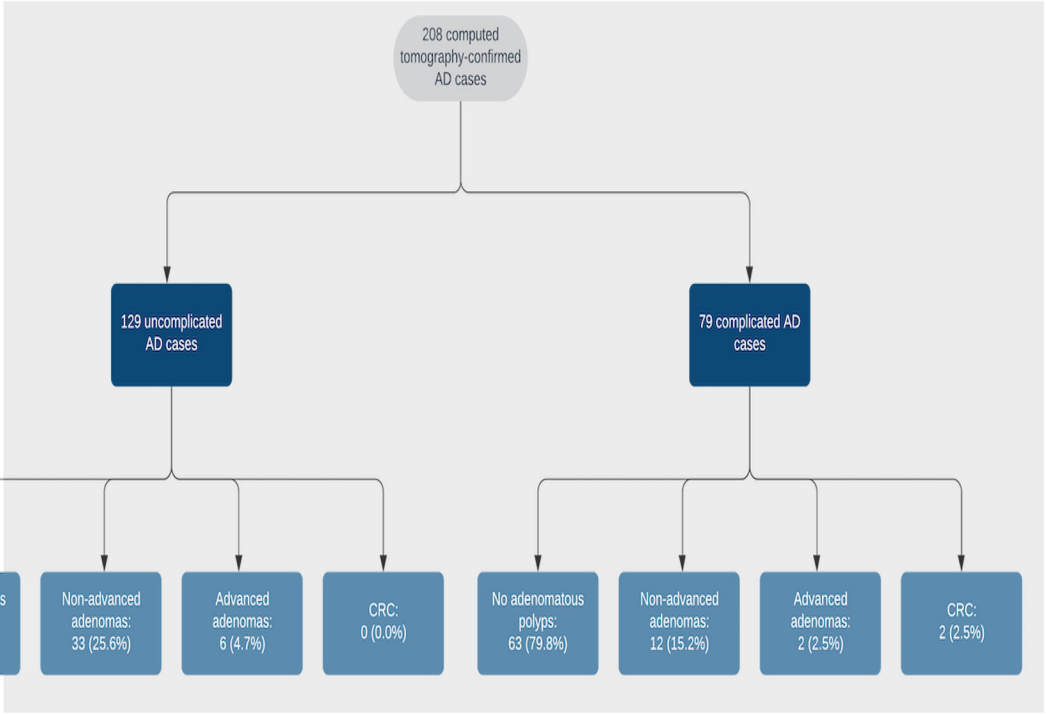

Figure 1.
Flow diagram of AD cases based on complicated vs uncomplicated AD and associated colonoscopic outcomes

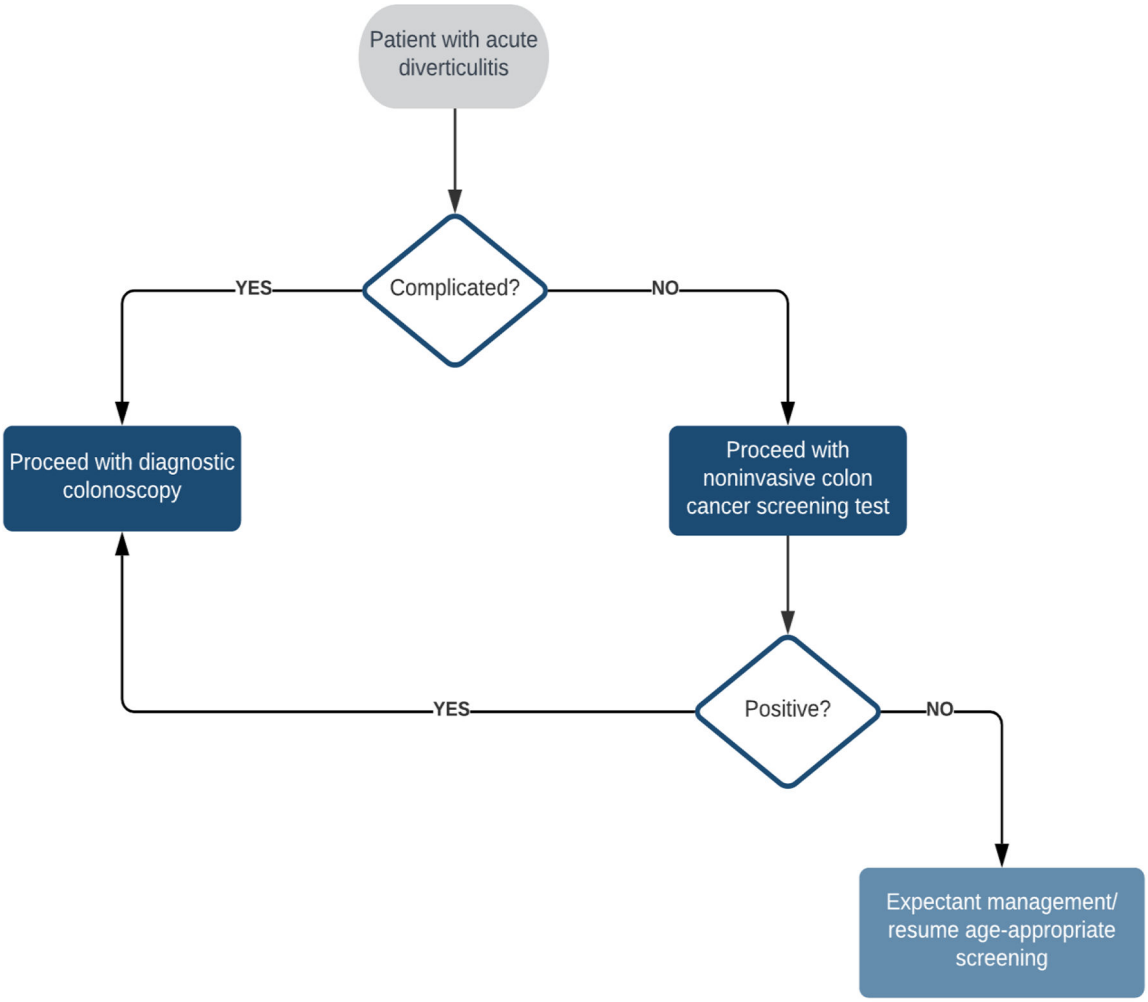

Figure 2.
Algorithm to guide post-AD colonoscopy decision-making

Table 1.

Characteristics in patients with CT-confirmed AD (n=208)

Male, n (%)	95 (45.7)
Female, n (%)	113 (55.3)
Race/Ethnicity, n (%)	
White	27 (13.0)
Hispanic	161 (77.4)
Asian	3 (1.4)
African-American	0 (0.0)
Middle-Eastern	8 (3.9)
Other	9 (4.3)
Ever smoker, n (%)	61 (29.3)
Age, median (IQR)	53 (46 – 59)
Age < 45 years, n (%)	40 (19.2)
BMI, median (IQR)	30 (27 – 34)
Family history of 1st degree relative w/ cancer	43 (20.7)
Personal history of cancer diagnosed prior to colonoscopy	8 (3.9)
History of proven diverticulitis	70 (33.7)
Hospitalized for diverticulitis	119 (57.5)
Lab values, median (IQR)	
Hemoglobin	13.7 (12.8 – 14.8)
WBC count	11.5 (8.7 – 13.6)
Platelet count	258.5 (215.0 – 308.0)
Absolute lymphocyte count	1.9 (1.4 – 2.5)
Transferrin saturation*	11.1 (5.4 – 23.0)
TIBC*	385.0 (305.0 – 419.0)
Ferritin*	22.0 (5.0 – 104.0)
Up to date on age-appropriate CRC screening	143 (68.8)
In patients with non-advanced adenomas (n=45)	23 (51.1)
In patients with advanced adenomas (n=8)	3 (37.5)
In patients with adenocarcinoma (n=2)	1 (50.0)
Time from acute diverticulitis diagnosis to colonoscopy, n (%)	
<2 months	22 (10.6)
2 – 6 months	97 (46.6)
6 – 12 months	56 (26.9)
>12 months	33 (15.8)
Uncomplicated diverticulitis, n (%)	129 (62.0)
Complicated diverticulitis, n (%)	79 (38.0)
Type of diverticulitis complication, n (%)	
Abscess	36 (17.3)

Fistula	15 (7.2)
Stricture	4 (1.9)
Perforation	39 (18.8)

IQR: interquartile range

Table 2.

Colonoscopic findings and outcomes in patients with CT-confirmed AD

Non-advanced adenomas present, n (%)	
Tubular adenoma	44 (21.6)
Sessile serrated adenoma	5 (2.4)
Adenocarcinoma present, n (%)	2 (1.0)
Adenocarcinoma encountered in region of colon where diverticulitis was seen on CT	2 (100.0)
Advanced adenoma present (includes polyps >1 cm, tubulovillous or villous adenomas, or polyps w/ high-grade dysplasia), n (%)	8 (3.9)
Tubular Adenoma >1 cm	2 (1.0)
Sessile serrated adenoma >1cm	1 (0.5)
Tubulovillous adenoma	5 (2.4)
Villous adenoma	0 (0)
Advanced polyp encountered in region of colon where diverticulitis was seen on CT	4 (50.0)
Advanced polyp encountered in region of colon different from where diverticulitis was seen on CT	4 (50.0)
Adenomatous polyp location, n (% among those with any adenomatous polyp, advanced or non-advanced, present)	
Cecum	4 (4.1)
Ascending colon	42 (42.9)
Transverse colon	15 (15.3)
Descending colon	11 (11.2)
Sigmoid colon	21 (21.4)
Rectum	5 (5.1)
Colonoscopy findings other than diverticulosis and polyposis	
IBD	2 (1.0)
Ischemic colitis	0 (0.0)
Segmental colitis associated with diverticulosis	6 (2.9)
Stricture	11 (5.3)
Mild proctitis/colitis/inflammation	6 (2.9)
Colonoscope size changed during procedure (down-sized to pediatric scope from adult scope)	16 (7.7)
Adverse events associated with post-AD colonoscopies (occurring within 1 week post-colonoscopy)	
None	208 (100)
Perforation	0 (0)
Bleeding	0 (0)
ED/Hospital visit for recurrent GI issue post-colonoscopy	0 (0)

* 4 patients had both tubular adenoma and sessile serrated adenoma present concurrently.

Table 3.

Characteristics and findings stratified by uncomplicated vs. complicated acute diverticulitis

	Uncomplicated diverticulitis (n = 129)	**Complicated diverticulitis (n = 79)**	**p-value**
Male, n (%)	41 (31.8)	54 (68.4)	**<0.001**
White, n (%)	19 (14.7)	8 (10.1)	0.400
Age, median (IQR)	55 (49 – 60)	50 (44 – 56)	0.001
BMI, median (IQR)	30.0 (27.0 – 35.0)	31.0 (27.0 – 34.0)	0.834
Ever smoker, n (%)	38 (29.5)	23 (29.1)	1.000
Non-advanced adenoma present, n (%)	33 (25.6)	12 (15.2)	0.169
Advanced adenoma present, n (%)	6 (4.7)	2 (2.5)	0.713
Adenocarcinoma present, n (%)	0 (0.0)	2 (2.5)	0.143

Table 4.

Characteristics and findings stratified by pre-colonoscopy fecal immunochemical test (FIT) result

	FIT negative (n = 48)	FIT positive (n = 3)	p-value
Male, n (%)	14 (29.2)	3 (100.0)	**0.033**
White, n (%)	9 (18.8)	0 (0.0)	1.000
Age, median (IQR)	59 (54 – 62)	57 (55 – 67)	0.602
BMI, median (IQR)	30.5 (27.0 – 37.5)	29.0 (26.0 – 40.0)	0.873
Ever smoker, n (%)	16 (33.3)	0 (0.0)	0.543
Non-advanced adenoma present, n (%)	12 (25.0)	3 (100.0)	**0.022**
Advanced adenoma present, n (%)	0 (0.0)	0 (0.0)	-
Adenocarcinoma present, n (%)	0 (0.0)	1 (33.3)	0.059