Title

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Journal

The American surgeon, 86(10)

ISSN

0003-1348

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Publication Date

2020-10-01

DOI

10.1177/0003134820964227

The American Surgeon
2020, Vol. 86(10) 1296–1301

DOI: 10.1177/0003134820964227
journals.sagepub.com/home/asu
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Evaluation of Pelvic Anastomosis by Endoscopic and Contrast Studies Prior to Ileostomy Closure: Are Both Necessary? A Single Institution Review

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Abstract

Contrast enema is the gold standard technique for evaluating a pelvic anastomosis (PA) prior to ileostomy closure. With the increasing use of flexible endoscopic modalities, the need for contrast studies may be unnecessary. The objective of this study is to compare flexible endoscopy and contrast studies for anastomotic inspection prior to defunctioning stoma reversal. Patients with a protected PA undergoing ileostomy closure between July 2014 and June 2019 at our institution were retrospectively identified. Demographics and clinical outcomes in patients undergoing preoperative evaluation with endoscopic and/or contrast studies were analyzed. We identified 207 patients undergoing ileostomy closure. According to surgeon's preference, 91 patients underwent only flexible endoscopy (FE) and 100 patients underwent both endoscopic and contrast evaluation (FE + CE) prior to reversal. There was no significant difference in pelvic anastomotic leak (2.2% vs. 1%), anastomotic stricture (1.1% vs. 6%), pelvic abscess (2.2% vs. 3.0%), or postoperative anastomotic complications (4.4% vs. 9%) between groups FE and FE + CE ($P > .05$). Flexible endoscopy alone appears to be an acceptable technique for anastomotic evaluation prior to ileostomy closure. Further studies are needed to determine the effectiveness of different diagnostic modalities for pelvic anastomotic inspection.

Keywords

pelvic anastomosis, anastomotic leak, stoma closure

Introduction

Anastomotic leak (AL) is the most feared complication of a pelvic anastomosis (PA), as it can lead to intra-abdominal sepsis.[1] Although it is controversial whether a defunctioning stoma (DFS) prevents AL, there is strong evidence to suggest a DFS reduces AL sequelae, including sepsis, peritonitis, and morbidity and mortality rates.[2] Because of the severe complications associated with AL, it is necessary to identify and avoid AL if possible. Therefore, in cases where a DFS has been made to protect a PA, surgeons will assess a patient's anastomotic viability prior to DFS reversal through physical examination, endoscopy, and/or imaging.[3,4]

Examination is performed to test the integrity of the anastomosis and rule out leak, stricture, and fistula.[3,5] Contrast enema has traditionally been viewed as the gold standard for PA evaluation.[3,6,7] However, with the interpretative ambiguity of contrast studies and the introduction of high definition (HD) endoscopy, the use of contrast studies has been challenged.[6,8] HD white light flexible endoscopy, defined as more than 650-720 lines of imaging resolution, enables detailed examination and identification of anastomotic abnormalities, such as dehiscence or vascular compromise.[9] In high risk anastomoses such as a PA, the need for high resolution and magnification for identification of these abnormalities to avoid potential leaks is important.[9] There is little scientific literature that considers the use of HD endoscopic

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modalities in conjunction with contrast studies. To account for this, the objective of this study is to compare flexible endoscopy and contrast studies for anastomotic inspection prior to DFS reversal. We hypothesized that flexible endoscopic evaluation can be used as an acceptable alternative to contrast studies for evaluation of a PA prior to ostomy reversal.

Methods

Patients with a PA who underwent a DFS reversal at the University of California, Irvine (UCI) Medical Center from July 2014 to July 2019 were reviewed. Consecutive patients were retrospectively identified after accessing a comprehensive UCI internal database that included all patients who had undergone colorectal surgery over the 5-year study period and was subsequently narrowed for anastomotic types with DFS reversal. Anastomotic types included colorectal, ileorectal, ileal pouch-anal anastomosis (IPAA), J-pouch colorectal, and J-pouch ileorectal anastomoses. Patient clinical data were reviewed for a method of anastomotic assessment and 30-day outcomes after reversal. Inclusion criteria were patient age over 18 years old and prior stapled PA undergoing an elective DFS reversal. Approval for this study was acquired through the institutional review board.

Patients were stratified via the types of anastomotic evaluation. Evaluation was performed based on the operating surgeon's preference, which included a group of 6 colorectal surgeons. Surgeon preference was based on the surgeon's prior training and experience with DFS reversal. Each evaluation method was performed as part of the surgeon's standard protocol for DFS reversal in an elective setting and was necessary for the surgeon's workup for DFS reversal. Three of the 6 surgeons regularly performed both endoscopic and contrast evaluations of the PA prior to reversal, while the remaining 3 surgeons performed endoscopic evaluation with selective use of contrast imaging when anastomotic abnormalities were noted. Groups were created as follows: patients undergoing both flexible endoscopic and contrast evaluation (FE + CE) and patients undergoing only flexible endoscopic evaluation (FE). Patients who only underwent contrast evaluation without endoscopic evaluation were excluded from comparison. Contrast evaluation was performed either via water-soluble contrast enema, CT scans of the abdomen/pelvis with rectal contrast, or small bowel follow-through study through the DFS. The water-soluble contrast enema and small bowel follow-through study included post-evacuation X-rays. Small bowel follow-through studies had been performed after attempts at water-soluble contrast enema were made but not tolerated by the patient. Endoscopic evaluation was performed by use of a HD flexible sigmoidoscope. All contrast evaluations were performed preoperatively, while endoscopic evaluations were performed either preoperatively or intraoperatively.

Demographics and clinical outcomes were analyzed. Demographics included age, gender, smoking status, chronic obstructive pulmonary disease (COPD), diabetes, hypertension, American Society of Anesthesiologists (ASA) score, body mass index (BMI), prior anastomosis, diagnosis, and time to closure. Clinical outcomes included AL, pelvic abscess, stricture, any anastomotic complication, ileus, readmission, and length of stay (LOS). AL was defined as radiological, endoscopic, or physical evidence of a staple line disruption, along with clinical signs of leakage requiring intervention. Anastomotic complication was defined as AL, pelvic abscess, or stricture. The primary outcome was AL. Secondary outcomes were pelvic abscesses, strictures, or any anastomotic complication.

Pearson chi-square testing for categorical variables and unpaired student's *t*-test for continuous variables were used to perform the univariate analysis. Statistical significance was set at $P < .05$. Data analysis was carried out using SAS software, version 9.4 (SAS Institute, Inc., Cary, North Carolina USA).

Results

Demographics of Patients Undergoing Stoma Reversal

A total of 207 patients were identified to have undergone DFS reversal for a PA at a single academic institution by 6 colorectal surgeons from 2014 to 2019. These patients underwent endoscopic and/or contrast evaluation of their PA prior to reversal according to the preference of the operating surgeon. Of these 207 identified patients, a total of 191 patients (92.3%) underwent endoscopic evaluation using a HD flexible sigmoidoscope. In addition, a total of 111 patients (53.6%) underwent contrast evaluation either through water-soluble contrast enema (106/111, 95.5%), CT imaging with rectal contrast (3/11, 2.7%), or small bowel follow-through study from the DFS (2/111, 1.8%). For comparison groups, 100 patients (48.3%) were identified to have undergone both endoscopic and contrast evaluation (FE + CE), while 91 patients (44.0%) underwent only endoscopic evaluation (FE) prior to DFS reversal. A total of 16 patients (7.7%) were not included in either comparison groups as these patients had only undergone either contrast evaluation or physical examination for eventual reversal.

The average age of the FE group was 54.1 ± 14.3 years compared to 48.9 ± 15.8 years in the FE + CE group ($P = .02$). There were no significant differences when comparing the defined groups in terms of smoking status, COPD, diabetes, or BMI. All patients were ranked as ASA class 1 to 3. The FE group had higher rate of ASA 3 status

Table 1. Patient Demographics, Comorbidities, and Operative Type.

	Flexible endoscopy	Flexible endoscopy and contrast study	
	N = 91	N = 100	*P*
Mean age, years (SD)	54.1 ± 14.3	48.9 ± 15.8	.02
BMI (kg/m^2)	26.9 ± 6.9	26.9 ± 5.7	.90
Male gender	56 (61.5%)	53 (53%)	.20
Comorbidities			
Smoking	6 (6.6%)	10 (10%)	.39
COPD	1 (1.1%)	2 (2%)	.60
Diabetes mellitus	14 (15.4%)	9 (9%)	.18
Hypertension	30 (33%)	20 (20%)	.04
ASA class			
1	2 (2.2%)	0 (0%)	.03
2	24 (26.4%)	41 (41%)	.03
3	65 (71.4%)	59 (59%)	.03
Prior anastomosis			
Colorectal	69 (75.8%)	51 (51%)	.004
Ileorectal	1 (1.1%)	1 (1%)	.004
J-pouch colorectal	4 (4.4%)	5 (5%)	.004
Ileal pouch-anal anastomosis	16 (17.6%)	43 (43%)	.004
J-pouch ileorectal	1 (1.1%)	0 (0%)	.004
Diagnosis			
Rectal cancer	64 (70.3%)	48 (48%)	.002
Inflammatory bowel disease	16 (17.6%)	41 (41%)	.002
Diverticulitis	2 (2.2%)	5 (5%)	.002
Other	9 (9.9%)	6 (6%)	.002
Mean time to closure, days (SD)	147.6 ± 212.9	141.5 ± 138.5	.80

Abbreviations: COPD, Chronic obstructive pulmonary disease; ASA, American Society of Anesthesiologists; BMI, body mass index.

compared to the FE + CE group (71.4% vs. 59%, $P = .03$). Rectal/rectosigmoid cancer was more prevalent in the FE group (70.3% vs. 48%, $P = .002$). Inflammatory bowel disease was more prevalent in the FE + CE group (41% vs. 17.6%, $P = .002$). The FE group had higher rate of low colorectal anastomosis (75.8% vs. 51%, $P = .004$). IPAA was higher in the FE + CE group (43% vs. 17.6%, $P = .004$). The average time to closure for the FE and FE + CE groups was similar (147.6 ± 212.9 days vs. 141.5 ± 138.5 days, $P = .80$) (Table 1).

Clinical Outcomes/Morbidity for Patients Undergoing Stoma Reversal

For all clinical outcomes, there were no significant differences when comparing both FE and FE + CE groups. Three ALs (3/207, 1.4%) were identified in the entire patient cohort. AL rates after DFS takedown was 2.2% for the FE group and 1% for the FE + CE group ($P = .51$). No abnormalities had been identified on contrast studies or endoscopy in these patients who experienced AL. There was also no significant difference between the FE and FE + CE groups for pelvic abscesses (2.2% vs. 3%, $P = .70$) or postoperative strictures (1.1% vs. 6%, $P = .07$). There was no significant difference between the FE and FE +CE groups for postoperative anastomotic complications (4.4% vs. 9%, $P = .2$). Ileus (13.2% vs. 6%, $P = .09$) and readmission rates (11% vs. 15%, $P = .40$) were similar for each group. The mean LOS were similar for the FE and FE + CE (3.9 ± 5.9 days vs. 2.7 ± 1.95 days, $P = .08$) (Table 2).

Anastomotic Abnormalities From Contrast and Endoscopic Evaluation Methods

Anastomotic abnormalities, defined as evidence of AL, fistula, sinus tracts, or stricture, were demonstrated in 10.8% of all contrast studies and 15.2% of all endoscopic studies. Compared to the patients in the FE group, patients in the FE + CE group had a higher number of anastomotic abnormalities detected prior to DFS reversal (24.0% vs. 12.1%, $P = .03$). Out of 35 patients identified to have abnormalities, 25 patients had strictures, and 10 patients had either anastomotic sinus tracts, diverticula, or fistulas. These 10 patients underwent delay in DFS closure to allow further healing of the anastomosis. Of the patients who had an anastomotic stricture, 1 patient developed a pelvic abscess; another patient developed

Table 2. Key Clinical Outcomes of Stoma Reversal Surgery.

	Flexible endoscopy	Flexible endoscopy and contrast study	
	N = 91	N = 100	*P*
Anastomotic leak	2 (2.2%)	1 (1%)	.51
Pelvic abscess	2 (2.2%)	3 (3%)	.70
Stricture	1 (1.1%)	6 (6%)	.07
Any complication	4 (4.4%)	9 (9%)	.20
Ileus	12 (13.2%)	6 (6%)	.09
Readmission	10 (11%)	15 (15%)	.40
Mean length of stay, days (SD)	3.9 ± 5.9	2.7 ± 1.95	.08

a colovesicular fistula requiring re-diversion over long-term follow-up. There were no re-diversions in patients who had delayed DFS closure over long-term follow-up.

Concordance between the endoscopic and contrast study evaluation methods was 82% (82/100). Of the 24 anastomotic abnormalities identified in the FE + CE group, 12 anastomotic abnormalities were captured only on endoscopy and not on contrast study, compared to 6 which were captured only on contrast study and not on endoscopy. Of the 12 anastomotic abnormalities identified by only endoscopic evaluation in the FE + CE group, 11 abnormalities were anastomotic strictures and 1 was a sinus tract at the anastomotic site. Of the 6 anastomotic abnormalities identified by only contrast study in the FE + CE group, 5 abnormalities showed radiologic evidence of a sinus tract, while the remaining abnormality showed radiologic evidence of an anastomotic stricture.

Discussion

Despite the common practice of contrast studies for PA evaluation, our study found that there were no significant differences in AL, pelvic abscesses, strictures, or overall anastomotic complications when comparing patients who underwent flexible endoscopy alone vs. patients who underwent endoscopy and contrast studies. The leak rate in the endoscopic group was 2.2%, while the leak rate was 1% in the endoscopic and contrast imaging group; the overall AL rate after DFS reversal of the entire patient cohort was 1.4%. This suggests that flexible endoscopy alone, when compared to patients undergoing both contrast imaging and endoscopic evaluation, can be used as an acceptable method for anastomotic evaluation prior to DFS reversal.

AL after surgery involving a PA varies widely in practice, with leak rates quoted from 0-8%[10-12] and mortality rates of 15.8%-32%.[13,14] Our AL rate (1.4%) falls below the normal leak rates quoted in literature despite having 16.9% anastomotic complication rate. This is likely due to our broad definition of anastomotic abnormalities. Because of the consequences associated with AL, it has become routine practice at many institutions to perform anastomotic inspection prior to DFS takedown.[1,7,8] No clear consensus exists on which evaluation modality of a PA is best. While contrast imaging has become the gold standard as it is helpful in assessing for AL, sinuses, or fistulas, interpretation of these contrast studies can be difficult and therefore may not be necessary.[5,15] The quality of the study is also dependent on the radiologist's interpretation and the technician applying the contrast enema. In a retrospective examination of patients with clinically suspected AL, Doeksen et al. found contrast imaging to have a low negative predictive value (73%); they concluded that radiographic imaging should be restrictively applied to only clinically suspected AL.[16] Many studies have highlighted the variable success of contrast imaging, with identification rates of AL being anywhere from 5% to 80%.[17]

However, the majority of these studies only evaluated contrast studies and analyzed its effect on AL prevention, as opposed to endoscopic evaluation. In a single-center retrospective review of 81 patients who had undergone a low anterior resection with DFS reversal, routine contrast enema performed in 69 patients identified an AL rate of 3.7%; the authors argued against the routine use of contrast enema prior to DFS reversal, given the low rate of AL.[3,18] In fact, this study also identified 12 patients who underwent only endoscopic evaluation of their PA prior to reversal; although no statistical comparisons were made to show differences between endoscopic and contrast study evaluation, none of these 12 patients experienced AL or postoperative complications.[18] In addition, a prospective cohort study in 129 patients with colorectal/coloanal anastomosis or IPAA showed that clinical evaluation via digital rectal examination provided more clinically relevant information compared to contrast studies.[3,15]

Similar to prior literature, our data question the utility of contrast studies and illustrate that contrast studies in addition to endoscopy do not add benefit in examination of a PA when compared to only endoscopy. Our data showed that there were no clinically significant differences in AL, pelvic abscesses, strictures, or overall anastomotic complications between the FE and the FE +

CE groups. This is likely due to the fact that endoscopic modalities have become more advanced with the introduction of HD and have shown improvement at detection of colorectal pathologies like colon and rectal polyps.[9,19] As such, HD endoscopy has likely translated to better visual inspection of a PA, although no study has examined this. In addition, contrast imaging of a PA can be challenging to interpret and sometimes deceiving.[5,15] In a large systematic review and meta-analysis, Habib et al found that contrast enemas have moderate sensitivity (79.9%) and low positive predictive value (64.6%) for discovery of clinically significant anastomotic complications; they concluded that the benefit of contrast enemas is uncertain in asymptomatic patients without clinical suspicion of AL.[3,4] Other studies illustrated that contrast imaging can have a high false-negative rate (35%) and high interobserver variability (14%), suggesting that radiological imaging of a PA should be interpreted with caution.[16] As such, with advancing endoscopic technology and the occasional deception of contrast imaging, it seems that FE alone can be a suitable method for PA when compared to FE + CE. Our data also seem to support the practice of performing the FE right at the time of DFS closure in the operating room, thus possibly saving patients' time and costs.

This study should be considered with certain limitations in mind. Due to the retrospective design of our study, inherent biases exist within the study, including selection bias. Decisions on whether to perform endoscopic vs. contrast imaging evaluation as well as what type of operation for DFS reversal were made at the discretion of the operating surgeon. As such, inherent preferences by each operating surgeon potentially skewed each group's sample sizes, perhaps leading to a larger contingency of FE patients in the case cohort in comparison to a smaller contingency of FE + CE patients in the control cohort. Also, small sample sizes of patients in both FE and FE + CE groups likely reduced the overall power of the study. In addition, given that this is a retrospective study, we cannot make a conclusion regarding cause and effect.

Nevertheless, this study suggests that FE, when compared to patients undergoing both FE + CE, can be used an acceptable alternative by itself for anastomotic evaluation prior to reversal of a protective DFS. Large randomized prospective studies are needed to determine the effectiveness of different diagnostic modalities for pelvic anastomotic inspection.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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