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Patient factors may predict anastomotic complications after rectal cancer surgery
Anastomotic complications in rectal cancer

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HIGHLIGHTS

- Risk factors for anastomotic complications include malnutrition, radiation, and ischemia.
- Transfusions have been associated with increased complications.
- Hemoglobin level <11 gr/dl might be associated with increased risk of anastomotic leak.
- Presence of diverting stoma does not affect the incidence of anastomotic leaks.

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ABSTRACT

Purpose: Anastomotic complications following rectal cancer surgery occur with varying frequency. Preoperative radiation, BMI, and low anastomoses have been implicated as predictors in previous studies, but their definitive role is still under review. The objective of our study was to identify patient and operative factors that may be predictive of anastomotic complications.

Methods: A retrospective review was performed on patients who had sphincter-preservation surgery performed for rectal cancer at a tertiary medical center between 2005 and 2011.

Results: 123 patients were included in this study, mean age was 59 (26–86), 58% were male. There were 33 complications in 32 patients (27%). Stenosis was the most frequent complication (24 of 33). 11 patients required mechanical dilatation, and 4 had operative revision of the anastomosis. Leak or pelvic abscess were present in 9 patients (7.3%); 4 were explored, 2 were drained and 3 were managed conservatively. 4 patients had permanent colostomy created due to anastomotic complications. Laparoscopy approach, BMI, age, smoking and tumor distance from anal verge were not significantly associated with anastomotic complications. After a multivariate analysis chemoradiation was significantly associated with overall anastomotic complications (Wall = 0.35, $p = 0.05$), and hemoglobin levels were associated with anastomotic leak (Wald = 4.09, $p = 0.04$).

Conclusion: Our study identifies preoperative anemia as possible risk factor for anastomotic leak and neoadjuvant chemoradiation may lead to increased risk of complications overall. Further prospective studies will help to elucidate these findings as well as identify amenable factors that may decrease risk of anastomotic complications after rectal cancer surgery.

1. Introduction

Anastomotic complications following rectal cancer surgery occur with varying frequency, from 1.8 to 19.8% [1–3]. Of these complications, anastomotic leak is the most morbid complication, with reported incidences ranging between 1.8 and 10.4% [1,4–6].

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This wide range may be due to the variable definitions used in the literature.

Male gender, preoperative radiation, BMI, hypoalbuminemia, use of defunctioning stoma and low anastomoses have been implicated as predictors in previous studies, but their definitive role is still under review and other factors have yet to be identified.

The objective of our study is to describe the risk factors associated with anastomotic complications in patients who had restorative proctectomy performed for rectal cancer. We hypothesize that anastomotic leaks are associated with conditions that affect the following factors: amount of oxygen carried in the blood stream (e.g. pulmonary diseases, smoking habits, anemia), vasculature abnormalities or inflammation (e.g. atherosclerosis, smoking habits, hypoalbuminemia), and integrity of the tissues involved in the anastomosis (e.g. type of anastomosis, technique, radiation, inflammation).

2. Methods

2.1. Study design

We conducted a retrospective analysis of a prospectively collected database of all patients who underwent elective restorative proctectomy for rectal cancer at Rush University Medical Center from January 2005–June 2011. No exclusion criteria were applied. This study was approved by the Institutional Review Board (IRB) at Rush University Medical Center (RUMC).

Laparoscopic or open approach was selected by the surgeons before the procedure, these decisions were largely based on patients comorbidities, previous surgical and medical history. The anastomotic technique involved the use of a stapler or a handsewn technique at the surgeon's discretion. Inspection of 'donuts' and intraoperative leak testing by air insufflation was performed in most of the cases. Defunctioning stoma was used in cases when technical difficulties related to anastomosis creation were present or preoperative radiation was administered. If defunctioning stoma was present, patients underwent contrast enema and/or flexible sigmoidoscopy before reversal to evaluate for anastomotic leak or stenosis. All surgeries were performed by two board-certified colorectal surgeons.

Medical records were reviewed and the following factors were extracted and entered into a database: age, gender, body mass index (BMI), history of coronary artery disease, diabetes mellitus, American Society of Anesthesiologist (ASA) classification, distance of tumor from anal verge, neoadjuvant chemoradiation therapy, type of surgery, approach, length of surgery, method of anastomosis, level of anastomosis from the anal verge, use of defunctioning stoma, and pathology features.

The primary outcome of the study was incidence of anastomotic complications which were classified as anastomotic leakage or stenosis. Anastomotic leakage was defined as total or partial breakdown of the connection and subsequent leakage of gastrointestinal contents or abscess formation demonstrated clinically or radiographically (computed tomography scan or barium enema). Stenosis was defined as narrowing of the anastomotic site characterized by an inability to pass the surgeon's index finger or a colonoscope, or narrowing demonstrated on a contrast study.

2.2. Statistical analysis

All quantitative variables are reported as a mean with an associated range. All patients included in the prospectively collected database were included in the analysis, and no sample size calculation was performed. Chi square was used to compare nominal variables (e.g.: neoadjuvant chemoradiation, gender, approach, stoma creation). Independent *t*-tests or non-parametric Mann–Whitney test were performed as appropriate to compare continuous variables in univariate analyses (e.g.: age, hemoglobin, length of surgery, length of stay). All *p* values were 2-tailed, and $p < 0.05$ was the criterion for statistical significance. Factors with a *p* value <0.10 in the univariate analyses were entered into the stepwise multivariate logistic regression. No subgroup or sensitivity analyses were performed. In case of missing data, only cases with complete data in the variable of study were included in the analysis; no imputation system for missing data was used. All statistical analyses were conducted using SPSS computer program (IBM SPSS 21).

3. Results

One-hundred twenty-three patients were included in this study. The mean age was 59 years (26–86); 58% were male and 42% were female. Stapled anastomoses were performed in 110 patients (89%), 12 were handsewn and one used a compression ring. The characteristics of patients are summarized in Table 1.

There were 33 complications in 32 patients (27%). The mean length of follow-up time after surgery was 23 months (range 0–70 months); the median was 17 months. Overall, eight patients required surgery for any anastomotic complication, and four patients had a permanent colostomy created due to anastomotic complications.

Stenosis was the most frequent complication (24/33, 72%). The average time to diagnosis of anastomotic stenosis was 204 days (range 17–890 days). Eleven patients required dilatation, four had operative revision of the anastomosis, and the nine remaining patients required only finger dilatation.

Anastomotic leak or pelvic abscess were present in nine patients (7.3%); five (4%) were diagnosed clinically within 14 days of surgery (mean 9 days, range 6–14 days). Four were diagnosed radiographically after surgery (mean 198 days, range 94–254 days); these were asymptomatic and identified during routine exam before ileostomy reversal. Four patients required exploration (exploratory laparotomy/laparoscopic with peritoneal lavage, ileostomy formation), two were drained percutaneously and three were treated with antibiotics and observation.

Table 2 shows the univariate and multivariate analyses for anastomotic complications. Neoadjuvant chemoradiation was

Table 1
Demographics.

Variable	Overall ($N = 123$)
Age (Mean ± SD)	59.24 ± 12.7 (range 26–86)
Gender	
• Male	71 (57.7%)
• Female	52 (42.3%)
Body mass index (Mean ± SD)	27.24 ± 5.7 (range 26.17)
Approach	
• Open	77 (63.1%)
• Laparoscopy	45 (36.9%)
ASA	
• 1	2 (1.6%)
• 2	57 (46.3%)
• 3	34 (27.6%)
• 4	2 (1.6%)
Technique	
• Stapled	110 (89%)
• Handsewn	12 (9.75%)
• Anastomotic ring	1 (0.81%)
Anastomotic complications	32 Patients (27%)
• Stenosis	24 (19.5%)
• Leakage or abscess	9 (7.3%)
○ Clinical	5 (4%)
○ Radiographic	4 (3.3%)