Anastomotic Leak After Bowel Resection: Defining The Complications Of Interest

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Abstract

Abstract Background: Anastomotic leak may be the most important quality indicator after intestinal anastomosis. Yet, there is great variation in the definitions and qualifying criteria for diagnosis, limiting the ability to benchmark and define best practices. We aimed to analyze the spectrum and incidence of infectious complications that can reasonably be described as a leak after intestinal anastomosis based on a standardized classification system and peer review process.

Methods: Consecutive patients undergoing bowel resection with anastomosis at an academic medical center from 2008-2012 were identified from a prospective quality database. Postoperative anastomotic complications were broken down into four complications of interest: anastomotic leak, SSI deep, SSI organ space, and fistula

Results: 925 patients had resection with anastomosis during the study period by 25 surgeons (range 1-263 cases). 5 surgeons performed 722 (78%) of the cases. 73 patients had one of the four complications of interest (7.8%), including 32 “classic” leaks (3.5%), 17 SSI deep (1.8%), 15 SSI organ space (1.6%) and 9 postoperative fistulas (1.0%).

Conclusions: Several different postoperative infectious complications can complicate bowel resection with anastomosis, and reasonably be described as a “leak”. We suggest that series describing the incidence of leak after bowel anastomosis report these four outcome measures separately to facilitate more meaningful and reliable comparisons.

KEYWORDS: anastomosis, leak, classification, complications
INTRODUCTION

Anastomotic leak is perhaps the most feared complication of bowel surgery.\(^1\) Management can require prolonged hospitalization with vast consumption of resources, reoperations in a hostile abdomen, and the need for an intestinal stoma.\(^2\) The morbidity and cost associated with an anastomotic leak highlight the importance of prevention and the potential value of tracking leak rates as a primary quality indicator after bowel resection.

Although many risk factors for anastomotic failure have been described,\(^3-6\) we seldom understand exactly why a leak occurred in any individual case, making meaningful quality improvement initiatives a formidable challenge. Further, the broad array of definitions and criteria for diagnosis have made benchmarking and comparative analyses of limited utility.\(^7-9\) In actuality, there is a spectrum of postoperative infectious complications that could be considered to represent an anastomotic leak.\(^10\)

We aimed to categorize and compare these complications in a large cohort based on a standardized classification system and rigorous peer review process. More specifically, we sought to determine the relative frequency of clinical endpoints that can reasonably described as representing an anastomotic leak. A secondary aim was to assess the variability of these four endpoints amongst high and low volume surgeons.

METHODS

The Surgical Activity Tracking System (SATS), a prospectively maintained complication database, was queried to identify patients 18 years and older who underwent resection of the small and/or large intestine with anastomosis at Fletcher Allen Health Care (FAHC), the teaching hospital of the University of Vermont College of Medicine, from January 1, 2008 through December 31, 2012. This included CPT codes 44202, 44204, 44205 and 44207 for laparoscopic cases and 44120, 44125, 44140, 44145, 44150, 44153, 44160, 44626 and 45119 for open procedures. Patients who had an electively planned intestinal stoma created (either as definitive management or to protect a distal anastomosis) or who underwent closure of a preexisting stoma were excluded.

Patients were seen daily by a specially trained nurse practitioner who rounded with house-staff and identified complications in real time. Patients were also seen after discharge in the surgery clinic where any additional complications were noted. All complications were reviewed and validated at bimonthly meetings of
the surgical team including the nurse practitioner, surgery attendings and residents. Details of the SATS program have been reported elsewhere.\textsuperscript{11}

As defined below, all patients who suffered from a “classic” anastomotic leak, SSI deep, SSI organ-space or postoperative fistula were considered as suffering a complication of interest (CI). Patients were determined to have a “classic” anastomotic leak if an anastomotic defect was diagnosed at reoperation, if there was extravasation of enteric contrast on a postoperative radiologic study (CT scan or contrast enema), if there was loculated fluid with air immediately surrounding the anastomosis on a postoperative CT scan, or if enteric contents were observed coming from a surgical drain, if present. A postoperative fistula was diagnosed if patients developed bilious or feculent material from their surgical wound, an old drain site, or an adjacent organ (e.g. vagina) in the absence of the previously described criteria for an anastomotic leak. The definitions and codes for deep surgical site infection (SSI Deep) and organ space infection (SSI Organ/Space) were based on the corresponding \textit{International Classifications of Disease, 9th Edition} complication codes for surgical site infections.

\textbf{SSI Deep}

SSI Deep (998.5) involves the skin, subcutaneous (SC) tissues, fascia, or muscle, but does not involve an organ space or wound infection. A deep incisional SSI must occur within 30 days after the operative procedure \textit{and} involve deep soft tissues (e.g., fascial and muscle layers) of the incision \textit{and} the patient has at least one of the following:

a. Purulent drainage from the deep incision but not from the organ/space component of the surgical site

b. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (38°C) or localized pain or tenderness, unless incision is culture -negative

c. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination

d. Diagnosis of a deep incisional SSI by a surgeon or attending physician

\textit{Note:} Classify infection that involves both superficial and deep incision sites as a deep incisional SSI.
**SSI Organ/Space**

An organ/space SSI (998.59) involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure. An organ/ space SSI must meet the following criteria: Infection occurs within 30 days after the operative procedure and infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure and the patient has at least one of the following:

a. Purulent drainage from a drain that is placed through a stab wound into the organ/space

b. Organisms isolated from an aseptically obtained culture or fluid or tissue in the organ/space

c. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination

d. Diagnosis of an organ/space SSI by a surgeon


*Note:* Occasionally, an organ/space infection drains through the incision. Such infection generally does not involve reoperation and is considered a complication of the incision. Therefore, it is classified as a deep SSI.

*Note:* Any complication observed upon hospital readmission or in the outpatient setting, even if beyond 30 days, was also included.

We considered all four postoperative infectious complications to potentially be the consequence of an anastomotic leak. As such, we calculated leak rates based both on the diagnosis of a classic leak as well as inclusive of the other three categories. Specifically, utilizing the four complications of interest, minimal (classic leak/total operations) and maximal (total CI/total operations) leak rates were calculated for five high volume surgeons (those who performed over 50 anastomoses) and for the remaining surgeons who had a CI reported. Fisher’s exact test was used to compare the CI and leak rates for the high volume vs low volume surgeons. Logistic regression was performed to compare the outcomes
amongst the individual surgeons. The study was approved by the Institutional Review Board of the University of Vermont College of Medicine.

RESULTS

During the study period, 925 patients underwent a bowel resection with anastomosis by 25 surgeons (range 1-263 cases). Of these, 157 patients had an enteroenteric anastomosis, 299 had an ileocolic or ileorectal anastomosis, 222 had a colocolic anastomosis, 213 had a colorectal anastomosis, and 34 had multiple anastomoses. Three-hundred seventy-nine patients (40.9%) had their resection performed laparoscopically.

There were 73 patients who suffered a CI, representing an overall anastomotic complication rate of 7.8%. Out of the total 73 CIs, only 32 (43.8%) were classified as an anastomotic leak (3.5%; Figure 1). 17 patients (1.8%) had an SSI organ/space, 15 (1.6%) had an SSI deep and 9 (1.0%) developed a postoperative fistula from the anastomosis.

Of the 73 patients who suffered a CI, there were 43 elective, 15 urgent, 14 emergent cases and 1 trauma laparotomy. Five high-volume surgeons performed 722/925 operations (78%) and had 62/73 CI’s (84.9%). There was no difference between the CI and leak rate between the high volume and low volume surgeons (p=0.6). The CI rate among the high volume surgeons ranged from 4.3% to 9.9%, and the leak rate ranged from 1.8% to 5.4% (Table 1). For the remaining five surgeons who had patients with a CI, the maximal leak rate ranged from 3.6% to 29.4%; the minimal leak rate ranged from 0% to 5.8% (Table 2). There was no statistical difference in the leak rate amongst the individual surgeons, but one surgeon had a higher rate of CI (29.4%, p=.02). Fifteen surgeons, all of whom had performed less than 10 cases during the study period, had no reported complications of interest.

DISCUSSION

Several different postoperative infectious complications can complicate bowel resection with anastomosis, and meet reasonable criteria for the diagnosis of a leak.\textsuperscript{9} When patients develop clear signs and symptoms of peritonitis and are found at laparotomy to have diffuse peritoneal soiling, there is little or no debate about the diagnosis of an anastomotic leak. However, definitions and classification of postoperative intraabdominal infectious complications can be a
very murky proposition indeed. Bruce identified 56 different definitions of anastomotic leak in 97 reviewed studies. Without a consensus and a uniform classification system, it becomes challenging, if not impossible, to compare outcomes and define best practices. In this context, it is perhaps not surprising that the reported leak rates after intestinal anastomosis vary so dramatically in the literature, ranging from 1 to at least 19%. In this series, we restricted the specific diagnosis of “leak” to those patients who had an anastomotic dehiscence noted at surgery, enteric contents from a surgical drain, or based on unequivocal radiographic findings of a leak. Many of the patients with one of the other complications of interest would meet reasonable criteria for the diagnosis of anastomotic leak in other series depending on the diagnostic criteria for a leak. As such, we chose to add the categories of SSI deep, SSI organ space, and fistula, as additional entities worthy of reporting when a leak rate is calculated. We do not believe these are truly separate categories and clearly observed overlap in the clinical and radiologic presentations in these subgroups. Rather, we hoped to capture as many anastomotic infectious complications as we could to avoid the semantic and largely arbitrary distinctions that a dichotomous classification of “leak” versus “no leak” generally requires.

After “leak”, SSI deep was the most common complication of interest and was the most difficult to choose to include as a CI. These patients typically had purulent material that was not clearly enteric contents emanating from deep in their incision. If there was an accompanying intraabdominal abscess, these patients would have been classified as SSI organ space. But many of these patients did not have a CT scan and one is left to wonder whether there was an organ space infection that drained spontaneously through the wound. In patients who were imaged, there was often a deeper inflammatory response that might or might not be considered “normal” in the postoperative state and the radiologic findings were to a varying degree indeterminate. The ambiguities of imaging studies in making the diagnosis of an anastomotic leak have been noted by others. We readily admit that it is debatable whether these patients really ever had any form of “leak”; however, using this category diminishes the need for such a distinction and provides an opportunity for greater complication capture.

Similar semantic issues can be raised about both SSI organ space and fistula. When a patient develops a perianastomotic abscess with associated extraluminal contrast extravasation, one presumes that a leak has occurred and has sealed off. However, others might argue that the abscess might have formed first and then eroded into the anastomosis. In a similar light, one may not be able to determine if local or even remote intraabdominal abscesses were caused by a self-limited leak. The precise pathophysiology and sequence of events that result in a postoperative

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fistula can also be debated; but they do represent meaningful postoperative complications that surgeons seek to avoid.

Previous work from our institution has demonstrated meaningful variation in the anastomotic and overall complication rate amongst surgeons doing similar procedures.25 There was no obvious difference in leak rate between the high volume and low volume surgeons; however, this data should be interpreted with great caution as only the high volume surgeons utilize the independent nurse practitioner for complication tracking. Specifically, all five high volume surgeons are on the same surgical service utilizing the same trained nurse practitioner, the same housestaff and participate in the same quality conferences where definitions are agreed upon by consensus and cases are adjudicated. The other services also participate in peer review, but there are many differences in structure, emphasis and personnel.

There are a number of limitations of this study. As alluded to above, it is not always easy to neatly classify the complications into distinct categories and some may disagree with our diagnostic classification. There is also reason for caution in trying to draw overly broad conclusions about the quality of care based on this data. Although the complication identification mechanism and nomenclature was reasonably well standardized, there was no risk adjustment performed. Specifically, there are many factors that have been linked to anastomotic leakage26-29 and these were not measured in this series.

We were able to capture late anastomotic complications, which is important as we have previously shown that 12% of anastomotic leaks are diagnosed more than 30 days after surgery.30 However, it is always possible that a small number of patients were seen at other institutions with complications. Since FAHC is the only tertiary care institution serving a large geographic region, it seems unlikely that this is a major limitation.

We suggest that series reporting the rate of leakage after intestinal anastomosis categorize postoperative events into one of the four specific outcome measures to facilitate more meaningful and reliable interpretation. We hope that categorizing postoperative intraabdominal infectious complications into one of these readily recognizable categories will diminish the limitations of considering anastomotic leak as a “yes/no” variable.
REFERENCES


Figure 1: Breakdown of Complications of Interest by category

<table>
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Table 1: Complications of Interest and Anastomotic Leak Rates of High-Volume Surgeons

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Table 2: Complications of Interest and Anastomotic Leak Rates of Low-Volume Surgeons

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