



Original Article

Image-guided Percutaneous Drainage for Treatment of Post-Surgical Anastomotic Leak in Patients with Crohn's Disease

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Abstract

Background and Aims: Anastomotic leaks with abscess formation are a common complication after bowel surgery in Crohn's disease patients. Image-guided percutaneous drainage is an attractive alternative to reoperation because of decreased morbidity and length of hospital stay. Because data for this specific population are scarce, the purpose of this study is to determine the safety and efficacy of image-guided percutaneous drainage in the management of post-surgical anastomotic leak in patients with Crohn's disease.

Methods: A total of 41 patients who underwent percutaneous drain placement for the treatment of fluid collections due to anastomotic leak from September 2004 to November 2013 were retrospectively identified from the electronic medical record and picture archiving and communication system. Data recorded included number, size, and location of anastomotic leaks, number of drains placed, number of follow-up visits, post-drainage complications, abscess resolution, and subsequent surgeries.

Results: In all, 41 patients with 76 fluid collections were identified as having received percutaneous drains. The mean number of targeted fluid collections per patient was 1.5, and the mean duration between surgery and percutaneous drain placement was 18.5 days. The mean number of drains placed was 1.6, and the median drain size was 10 French [range 8–16 French]. One of 41 [2.4%] patients experienced a minor complication from drain placement [injury to a superficial abdominal artery] and no major complications occurred. Two of 41 [4.9%] patients required repeat surgeries.

Conclusions: Image-guided percutaneous drainage for the treatment of post-surgical anastomotic leaks in Crohn's patients is effective and safe, with low rates of complications and reoperations.

Key Words: Crohn's disease; bowel surgery; anastomotic leak; percutaneous drainage; abscess

1. Introduction

The majority of patients with Crohn's disease will require bowel surgery during their lifetime.¹ The postoperative complication rates are higher in patients with Crohn's disease than for other benign diseases.² Anastomotic leak is a frequent and severe postoperative complication after bowel resection and reanastomosis in these patients, occurring at rates between 1% and 30%.^{3,4,5,6} Defined as

the leak of luminal contents from a surgical join of two hollow viscera, anastomotic leak can be diagnosed using variations of clinical indicators like pain, peritonitis, and biochemical markers, as well as radiological studies showing fluid collections or gas-containing collections. Anastomotic leaks are detected anywhere from 3 to 45 days postoperatively.³ If untreated, anastomotic leaks can lead to abscess formation, peritonitis, and sepsis.^{5,7,8,9,10,11,12,13}

Historically, anastomotic leaks required additional surgical intervention. However, image-guided percutaneous drainage has become an attractive alternative to reoperation because of decreased morbidity and hospital stay.^{13,14,15,16,17,18} Currently, there are limited data available as to the efficacy and rate of complication when image-guided percutaneous drainage is performed for anastomotic leak in this specific patient population. The purpose of this study was to report such data by retrospectively reviewing cases at a single academic institution.

2. Methods

2.1. Study design

Institutional review board approval was obtained and all guidelines of the Health Insurance Portability and Accountability Act were followed. A retrospective review was initially performed that included all patients aged 18 years and older with Crohn's disease who underwent bowel anastomosis at a single academic medical centre from September 2004 to November 2013. The patients were identified using the electronic medical record and picture archiving and communication systems. Eligible patients for this study were those who underwent image-guided percutaneous drain placement for treatment of post-surgical anastomotic leak. Patients were determined to have an anastomotic leak if they had a fluid collection adjacent to an anastomosis identified on contrast-enhanced computed tomography [CT] within 1 month of the surgery in which that anastomosis was created, 41 patients were identified who met the criteria of the study.

Once identified, the patient's medical record was reviewed, and the following data points were recorded: [1] demographic data, [2] location of disease, [3] Montreal classification, [4] immunosuppressive medications, [5] date of procedure, [6] type of surgery, [7] indication for surgery, [8] initial surgery vs repeat surgery, [9] location of anastomosis, [10] location of anastomotic leak [left upper quadrant, right upper quadrant, left lower quadrant, right lower quadrant, abdominal wall, psoas gluteal, pelvic], [11] stoma creation, [12] size of abscess, [13] days post-surgery that drains were placed, [14] size and number of drains placed, [15] time to first follow-up, [16] duration of drainage, [17] number of manipulations/exchanges, [18] need for total parenteral nutrition [TPN], [19] complications of treatment including complications of sedation, drug-related allergic reactions, cardiopulmonary complications, infectious complications, bleeding, and non-target access, and [20] number of a repeat surgeries required to repair the anastomotic leak. The primary outcome was abscess resolution as determined by the lack of contrast leakage through drainage catheter under fluoroscopy. Other outcomes measured included post-drainage complications and subsequent surgery required.

2.2. Procedure

All image-guided drain placements were performed by or under the supervision of experienced academic interventional radiologists. Drainage catheters were placed using either ultrasound [US], computed tomography [CT], or a combination of US and CT guidance [Figure 1]. Drainage catheters were placed using standard techniques.¹⁹ Once access to the fluid collection was obtained, a self-locking pigtail drainage catheter, ranging from 8–16 French in size, was placed. Drainage catheter size was at the discretion of the operating physician.

The drains were flushed with normal saline, 5–10 ml once or twice a day, depending on operator preference. The patients returned every 2 weeks for drain study under fluoroscopy. The patient would

be evaluated earlier than 2 weeks if the output significantly declined or if there was concern that the drain may have become dislodged. During the follow up drain evaluation, the drains were exchanged if they appeared obstructed or malpositioned. Drains were removed when there was only minimal fluid cavity remaining on the drain study and there was no evidence for persistent fistula to the bowel [Figure 2].

All patients were initially treated with broad-spectrum antibiotics that individually, or in combination, covered Gram-negative organisms, Gram-positive organisms, and anaerobes, for 2–14 days. Patients who did not initially tolerate enteral nutrition [EN] were placed on TPN, until they were able to eat again.

2.3. Statistical analysis

The relationship between size of fluid collection and duration of drain, type of surgery and location of fluid collection, size of drainage tube and duration of drainage, and location of fluid collection and duration of drain were analysed and compared using Student's t-test or one-way analysis of variance [ANOVA] test. All other quantitative data were expressed as mean, median, and range.

3. Results

A total of 127 potentially eligible patients were identified as patients with Crohn's disease who underwent bowel surgery. Among these, 41 patients [32%] were identified as having an anastomotic leak managed with percutaneous drainage. Table 1 presents baseline patient characteristics, including age of patients, location of disease, age at diagnosis, Montreal classification, immunosuppressive medications, smoking status, and previous bowel surgery; 25 of 41 patients had previously undergone bowel surgery for their Crohn's disease at sites at or near the anastomotic site, whereas 16 patients had never undergone surgical intervention. Of the 25 patients who had previously undergone bowel surgery, 8 patients underwent ostomy takedowns. The indications for surgery included medication refractory disease [10 patients], enterocutaneous fistula repair [9 patients], ostomy takedowns [8 patients], lysis of adhesions [6 patients], bowel obstruction [4 patients], ileocolic fistula repair [1 patient], ileal fistula repair [1 patient], ostomy revision [1 patient], and jejunioileal fistula repair [1 patient]. Twelve of 41 patients had ostomies prior to surgery. In addition, 9 of 41 patients underwent the creation of a stoma during their bowel surgery, and 9 of 9 patients who underwent stoma creation also had additional bowel procedures performed at the same time. There were a total of 76 independent fluid collections identified. Of the 41 patients, 25 were taking at least one immunosuppressive medication during the course of surgery; these immunosuppressive medications included infliximab, prednisone, azathioprine, methylprednisolone, budesonide, and certolizumab. The immunosuppressive medications were withheld in 11 of 25 patients prior to drainage due to their acute infectious process but were continued in 14 of 25 patients. The incidence of clinical leakage by location of anastomosis and type of anastomosis is shown in Tables 2 and 3. The most common locations for the anastomotic leak were in the pelvis and right lower quadrant of the abdomen, and the most common types of anastomosis were side-to-side ileum and colon anastomoses and side-to-side small bowel anastomoses. The mean number of targeted fluid collections per patient was 1.5 [median 1; range 1–4], and 15 of 41 [38.1%] patients were treated for multiple abscesses. The mean volume of the abscesses resulting from anastomotic leak was 167.2 cm³ [median 59.5 cm³; range 1.8–1173.1 cm³], and the mean diameter of the abscesses resulting from anastomotic leak was 8.5 cm [median 8.0 cm; range 2.0–20.0 cm].

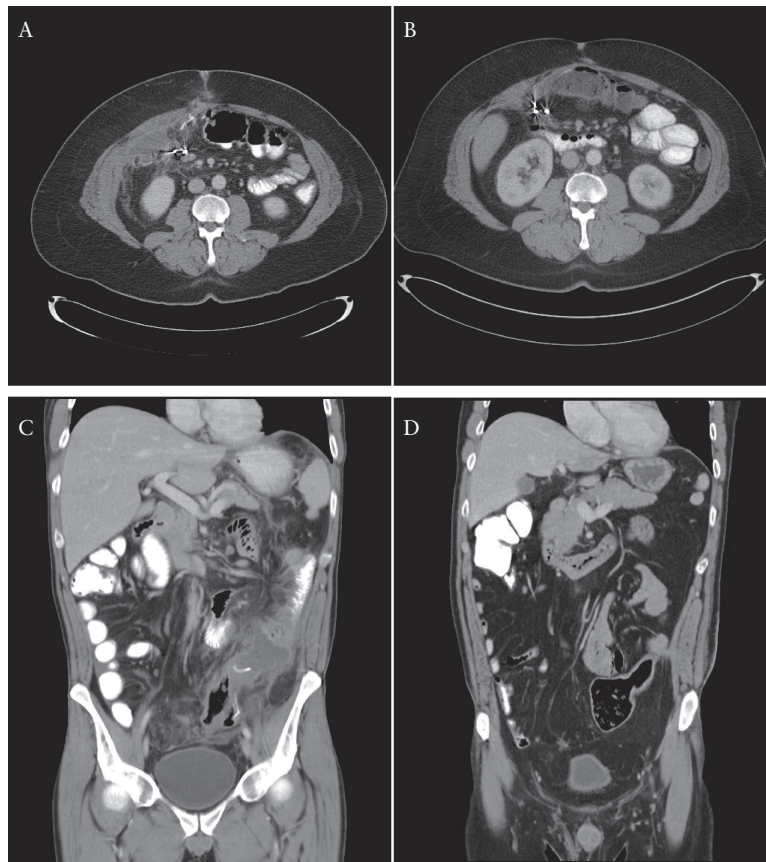


Figure 1. Contrast-enhanced computed tomography [CT] images of two patients showing the [A, C] anastomotic leak [white arrow] and abscess [grey arrow], and [B, D] resolution.

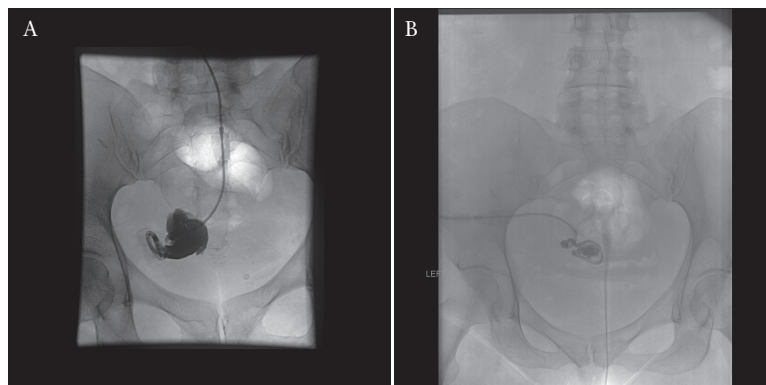


Figure 2. Anterior-to-posterior fluoroscopy images of a sinogram from one patient which shows an [A] unresolved fluid pocket and the [B] resolved fluid pocket.

The mean duration between surgery and percutaneous drain placement was 18.5 days [median 14 days; range 6–60 days]. Catheters ranged in size from 8 to 16 French [median 10 French]. The average number of drains placed was 1.6 [median 1; range 1–6]; multiple drains were placed because of a large fluid collection, undrained portions of the fluid collection, or new fluid collection development. Overall, the mean duration of drainage was 70.4 days [median 29 days; range 2–732 days]. Fluid volumes of greater than 50 cm³ resulted in significantly longer duration of drainage [$p < 0.0448$]. Furthermore, drain sizes of 12 or greater resulted in significantly longer durations of drainage [$p < 0.0001$]. The mean number of drain manipulations/exchanges because of obstruction

was 1.2 [median 0; range 0–14]. Overall, there was no obvious relationship between the location of the fluid collection and duration of drainage [$p = 0.9154$] nor type of anastomosis and duration of drainage [$p = 0.8967$]. Follow-up sinograms indicated fluid collection resolution, fistulas, undrained fluid pockets, or residual cavities. **Figure 2** shows fluoroscopic images from a sinogram showing an unresolved fluid pocket and the resolved drain endpoint.

The average time to first follow-up after drain placement was 9.7 days [median 8; range 2–25]. Of the 41 patients, 16 required TPN as a consequence of their bowel surgery, whereas the others maintained their regular diet. One patient [2.4%] experienced a minor complication from drain placement, injury to a superficial

Table 1. Baseline characteristics.

| Characteristic | Crohn's patients with anastomotic leak [n = 41] |
|-------------------------------|---|
| Age, years | |
| Mean | 40.5 |
| SD | 14.0 |
| Gender | |
| Male | 18 |
| Female | 23 |
| Location of disease | |
| Ileal | 8 |
| Colonic | 2 |
| Ileocolonic | 31 |
| Isolated upper disease | 0 |
| Age of diagnosis, years | |
| Mean | 21.1 |
| SD | 9.4 |
| Montreal classification | |
| A113b3 | 10 |
| A213b3 | 7 |
| A111b3 | 5 |
| A213b1 | 4 |
| A313b3 | 3 |
| A213b2 | 2 |
| A313b1 | 1 |
| A311b2 | 1 |
| A211b3 | 1 |
| pa113b3 | 1 |
| A212b1 | 1 |
| A212b3 | 1 |
| A313b2 | 1 |
| pa213b1 | 1 |
| pa213b3 | 1 |
| A211b1 | 1 |
| Immunosuppressive medications | |
| Infliximab | 7 |
| Prednisone | 10 |
| Azathioprine | 3 |
| Methylprednisolone | 3 |
| Budesonide | 1 |
| Certolizumab | 4 |
| Smoker | |
| Yes | 5 |
| No | 36 |
| Previous surgery | |
| Yes | 25 |
| No | 16 |

SD, standard deviation.

abdominal artery, which resolved spontaneously without the need for transfusion or an additional procedure. No major complications occurred during or after the procedure [no infectious sequelae, major bleeding events, non-target access, or fistulas. Of the 41 patients, 39 [95.1%] patients experienced resolution of the anastomotic leak, as confirmed by CT and drain study. Two of 41 [4.9%] patients required repeat surgeries to repair the anastomotic leak. The decision was made to operate because of the continued high output despite prolonged percutaneous drainage.

4. Discussion

The goal of our work was to determine the safety and efficacy of image-guided percutaneous drainage in the management of

Table 2. Location and number of anastomotic leaks.

| Location of anastomotic leak | Number of leaks |
|------------------------------|-----------------|
| RUQ | 11 |
| LUQ | 8 |
| RLQ | 16 |
| LLQ | 6 |
| Pelvis | 21 |
| Psoas gluteal | 8 |
| Abdominal wall | 5 |

RUQ, right upper quadrant; LUQ, left upper quadrant; RLQ, right lower quadrant; LLQ, left lower quadrant.

Table 3. Type of anastomosis and number of anastomotic leaks.

| Type of anastomosis | Number of leaks |
|--|-----------------|
| SB side-to-side | 16 |
| SB end-to-end | 5 |
| Ileum and colon side-to-side | 23 |
| Ileum and colon end-to-side | 4 |
| Colorectal side-to-end | 1 |
| Colorectal end-to-end | 2 |
| Colon side-to-side | 2 |
| Colon end-to-end | 1 |
| Ileum and proximal rectum side-to-side | 1 |
| Ileum J-pouch anal | 1 |
| End distal side proximal SB | 2 |

SB, small bowel.

post-surgical anastomotic leak in Crohn's patients. We found that 95.1% of patients who underwent percutaneous drainage experienced resolution of the anastomotic leak, as confirmed by CT and drain study, and did not require a repeat surgery to repair their anastomotic leak. There was one minor complication, injury to a superficial abdominal artery, and no major complications that occurred as a result of percutaneous drainage. In addition, the use of immunosuppressive medications did not limit patients from receiving percutaneous drainage. Overall, our results suggest that percutaneous drainage is safe and effective within this patient population.

Physicians are often confronted with the problem of how to treat post-surgical anastomotic leak in patients with Crohn's disease. Previous authors have supported both surgery and percutaneous drainage to treat these leaks in patients with and without Crohn's disease.^{20,21,22,23,24,25} In a retrospective study, Xie *et al.* found that percutaneous drainage resulted in a lower rate of post-drainage complications compared with the surgery group in patients with Crohn's disease.²² Furthermore, Gutierrez *et al.* found that time to resolution of abdominal or pelvic abscess in Crohn's disease is similar between percutaneous drainage and surgery.²¹

Our results are further supported by studies evaluating the percutaneous drainage of spontaneously formed intra-abdominal abscesses in Crohn's patients which do not arise from anastomotic leaks.^{18,21} Gutierrez *et al.* found that approximately two-thirds of Crohn's patients with intra-abdominal abscesses treated with percutaneous drainage do not require follow-up surgery for treatment of their abscesses within 1 year.²¹ Additionally, in a prospective study by Casola *et al.* in which percutaneous drainage was planned as the definitive therapeutic approach, 15 patients with Crohn's disease had successful abscess drainage percutaneously with no complications and no development of cutaneous fistula tracts. Drainage catheters were maintained from 8 days to 6 weeks, and only three

patients required surgery for complete resolution of the abscess in follow-up.¹⁸

Anastomotic leakage from colorectal surgery generates a considerable demand for hospital resources.²⁶ Consequently, the economic benefit of resolving leaks without surgery cannot be overstated. Studies by Ashraf *et al.* established that patients who underwent surgical repair of the anastomotic leak had significantly longer hospital stays compared with those managed with percutaneous drainage or antibiotics and were more likely to require intensive care.²⁷ Thus, resolving leaks using conservative management, including percutaneous drainage, could reduce the economic burden of anastomotic leak.

The main limitation of our study is its retrospective design. Second, despite the proximity of the fluid collections seen on CT to the recent bowel anastomoses, we could not be certain that all of these collections represented true anastomotic leaks. The leakage rate from our study was larger than in most previous studies, which may be attributed to the large number of immunosuppressive medications used in these patients.⁶ Our study did not collect data regarding post-drainage fistula formation.

In conclusion, image-guided percutaneous drainage for the treatment of post-surgical anastomotic leaks in Crohn's patients is effective and safe, with low rates of complications and reoperations.

Funding

None.

Conflict of Interest

None.

Author Contributions

JB collected data, analysed the data, and wrote the manuscript. RS collected data. AI, HY, and CB analysed the data, critically revised the manuscript, and approved the final version to be submitted. All the authors read and approved the final manuscript.

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