

# Use of Intra-Abdominal Drains

Frances J. Puleo, MD<sup>1</sup> Nitin Mishra, MD<sup>1</sup> Jason F. Hall, MD, MPH, FACS<sup>2</sup>

<sup>1</sup>Department of Surgery, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey, Edison, New Jersey

<sup>2</sup>Department of Colon and Rectal Surgery, Lahey Clinic, Burlington, Massachusetts

**Address for correspondence** Jason F. Hall, MD, MPH, FACS, Department of Colon and Rectal Surgery, Lahey Clinic, 41 Mall Road, Burlington, MA 01805 (e-mail: Jason.F.Hall@Lahey.org).

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## Abstract

### Keywords

- ▶ colon and rectal surgery
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- ▶ anastomosis
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The use of drains in colorectal surgery has been a subject of debate for several decades. Prophylactic drainage of the peritoneal cavity has become less popular in recent years. This change is due to several studies demonstrating that intraperitoneal drains do not adequately drain the peritoneal cavity and do not prevent or contain anastomotic leaks. Percutaneous drain placement has become the standard of care for patients with intra-abdominal abscesses. Selected anastomotic leaks in the stable patient can also be managed with percutaneous drains. In this article, the authors review in detail the use of drains and the literature to support their use in our everyday practice.

**Objectives:** On completion of this article, the reader should understand the role of prophylactic and therapeutic drainage in colorectal surgery, and be familiar with recent studies related to the use of drains in colorectal surgery.

The concept of using drains during surgical procedures has been documented for centuries. Hippocrates described the use of tubes to remove ascitic fluid from the abdominal cavity.<sup>1</sup> In the 19th century, Theodore Billroth believed that drainage of the peritoneal cavity was essential for saving the lives of patients after gastrointestinal surgery.<sup>1,2</sup> In 1964, Berliner studied dogs who underwent two colonic anastomoses, one of which had a rubber drain placed at the suture line. The dogs were sacrificed and 11 out of 20 dogs were found to have an anastomotic leak at autopsy at drain site. The authors of this study concluded that drain placement prevented omentum, visceral peritoneum, or small bowel from adhering to and therefore sealing colonic anastomosis.<sup>3</sup>

## Use of Drains in Colonic Anastomosis

In 1986, Hoffman et al performed the first human prospective study of prophylactic drainage of colonic anastomoses. Sixty patients were randomized to drainage or no drainage groups. The drainage group had the drain placed near but not touching the anastomosis. The drain was affixed to the skin and drained into a colostomy bag. All drains were removed on

the fifth postoperative day. Patients were followed for at least 30 days postoperatively. Two patients in the drainage group had clinical signs of an anastomotic leak. The quantity or character of the intraperitoneal drainage had not alerted the clinicians to the presence of an anastomotic leak.<sup>4</sup>

Several randomized studies were subsequently conducted examining anastomotic healing rates and other outcomes with or without drain placement. The results of a limited number of these studies are summarized in ▶ **Table 1**. Drain placement did not have a significant effect on the rate of anastomotic leak or other outcomes. These studies however had poor randomization and assessment of outcomes was subjective.<sup>5</sup>

In 2004, a meta-analysis was performed to review the use of drains as early indicators of leak and as treatment.<sup>1,6</sup> The authors performed a meta-analysis of 717 drained and 673 nondrained patients and assessed for anastomotic leak, wound infection, and respiratory complications. The authors concluded that there was no significant benefit of drainage in reducing risk of leak or other surgical complications.<sup>1,6</sup> The authors found that only 1 in 20 of the drains contained pus or enteric contents, which represented only a 5% sensitivity for the detection of anastomotic leaks.<sup>1,6</sup>

In 2004, the Cochrane Collaboration performed a systematic review of the literature on prophylactic use of drains in colorectal surgery. The review included six randomized controlled studies with 1,140 patients, comparing drainage and no drainage protocols after anastomosis in elective colorectal

**Table 1** Summarizes data from early randomized trials

	# Patients	Type of anastomosis	Anastomotic leak (drain) (%)	Anastomotic leak (no drain) (%)	Wound infection (drain) (%)	Wound infection (no drain) (%)
Sagar et al <sup>2</sup>	148	Colorectal	11.0	6.0	15.0	6.0
Johnson et al <sup>26</sup>	106	Colonic	12.2	10.5	20.4	17.5
Hoffman et al <sup>4</sup>	70	Colonic	3.5	3.3	14.2	6.6

surgery.<sup>7</sup> The primary objective was to determine if prophylactic drainage prevented clinical anastomotic leakage. The review also measured overall mortality, anastomotic leak, wound infection, reoperation, and extra-abdominal complications in the two groups.<sup>7</sup> A review of these six trials showed an overall mortality of 3% in the patients who had drains placed compared with 4% in the nondrainage group. This difference was not statistically significant.<sup>7</sup>

Anastomotic leak was defined as the presence of a radiologic dehiscence on postoperative enema. The rate of radiologic leak was 3% for drainage group versus 4% in the nondrainage group. Operative placement of a drain did not appear to be associated with the anastomotic leak rate. On further analysis of the data, based on the level of the anastomosis, there was no benefit to drainage of pelvic anastomosis; however, this was only reviewed in two of the six studies.<sup>7</sup>

In addition to their postulated effect on anastomotic healing, drains have been thought to increase pain, leading to possible pulmonary complications. There is a theoretical benefit in preventing wound infection. In the Cochrane Review, extra-abdominal complications were found to be at 7% for the drainage group compared with 6% for the nondrainage group. Drainage did not protect the wounds from infection or increase the rate of infection. Wound infection rates were the same in the two groups among all the studies. The authors concluded that there was insufficient evidence to support use of prophylactic drains in colorectal surgery.<sup>7</sup>

### Use of Drains after Low Pelvic Anastomosis

Although the aforementioned data does not appear to suggest that routine drainage of the peritoneal cavity is useful, there is some evidence for the use of prophylactic drainage in rectal surgery. Pelvic anastomosis has a higher rate of anastomotic leak when compared with colonic anastomosis.<sup>8-11</sup> After a total mesorectal resection, typically there is a large raw surface which typically secretes a large amount of serous and sometimes hemorrhagic fluid. The pelvis represents a fixed, dependent, cavity. These anatomic constraints make accumulation of a fluid collection more likely and it is postulated that drain placement can prevent formation of an abscess or seroma.<sup>8</sup>

Merad et al studied 494 patients who were randomized to a drain or no drain while undergoing rectal or anal anastomosis for a variety of different conditions. They examined the rates of anastomotic leakage in both groups as well as other postoperative complications. The leakage rate was similar

between the two groups: 6.8% for the drainage group and 6% for the no-drainage group. There were 18 deaths, 8 (3.2%) in those with drainage and 10 (4%) in those without drainage. Pelvic drainage did not prevent anastomotic leakage or prevent complications in this study.<sup>11</sup>

Brown et al focused solely on drain usage in anastomosis below the peritoneal reflection. In 8 months, the authors randomized 60 patients undergoing pelvic anastomosis to a drain or no drain group. They found no significant difference in postoperative complications in the drainage group compared with the nondrainage group. The overall leak rate in both groups was 7%, and there was no difference in the incidence of pulmonary complications or wound infections. The overall 30-day mortality for both groups was 1%.<sup>8</sup> Although this study had a small sample size, the authors concluded that prophylactic drainage does not improve the outcomes of patients undergoing low rectal anastomosis.<sup>8</sup>

In 2004, Peters et al reviewed the database of the Dutch TME trial to determine risk factors for anastomotic leakage. On review of the 924 patients enrolled, the presence of one or more pelvic drains after surgery was associated with a lower leakage rate: 9.6% of the patients with pelvic drainage had leakage, compared with 23.5% without a drain; which was statistically significant.<sup>12</sup> These authors also found that the need for reoperation after detection of anastomotic leak was significantly lower for patients with pelvic drainage than for those without a drain.<sup>12</sup> These results appear to favor the use of prophylactic drains in rectal surgery; however, some care is necessary in interpreting these results. There is a large element of selection bias in interpreting the differences in anastomotic leak rates in the two groups. The use of drains was not randomized, but rather left to the discretion of the operating surgeon. One could safely assume that patients who had difficult pelvic dissections were more likely to have a drain placed. It is also a safe assumption that patients with difficult dissections are also more likely to suffer from anastomotic leak. In addition, this study was also not designed or powered to study the effects of drains on anastomotic leaks, but rather the effect of radiation on local recurrence and mortality.<sup>12</sup>

In 2005, Yeh et al published a prospective study of 978 patients undergoing a low anterior resection in a single institution. Their objective was to investigate prophylactic pelvic drainage and risk factors associated with anastomotic leakage. In their study, surgeons picked the type of drain used during the operation. The authors studied multiple factors to determine risk factors for anastomotic leak. They concluded

that pelvic drainage was not associated with decreased leak rate.<sup>9</sup>

Tsujinaka et al studied 196 patients who underwent low anterior resection with TME to determine if drain placement had any effect on anastomotic leakage and its management. Anastomotic leak occurred in 21 (10.7%) of the 196 patients in the study. A change in the character of the drainage fluid was noted in 15 (71.4%) of the patients with an anastomotic leak. These patients were subsequently treated by nonoperative management, which consisted of nothing per mouth, hyperalimentation, and leaving the drain in place. The authors suggest that based upon their results, pelvic drainage may act as an early indicator of anastomotic leak and that placement of a drain may decrease the need for surgical intervention for an anastomotic leak.<sup>13</sup>

### Use of Percutaneous Drainage as Therapy

Although the use of operatively placed drains is controversial, percutaneous drainage can be used in certain clinical scenarios to avoid emergency surgery. Complicated diverticulitis can be treated with nonoperative management in 70 to 100% of cases. Percutaneous drain placement has a major role in this nonoperative management. Roughly 15% of patients with acute diverticulitis will develop an abscess.<sup>14</sup> In 2006, the practice parameters published by the American Society of Colon and Rectal surgeons suggested that patients with abscesses greater than 2 cm are candidates for percutaneous drain placement.<sup>14</sup> This treatment paradigm can sometimes prevent urgent surgery and a resultant stoma.<sup>14,15</sup> There are several studies that suggest that patients with diverticular abscesses treated with antibiotics alone have similar outcomes to those treated with antibiotics and percutaneous drainage. Durmishi et al examined 34 patients with diverticular abscesses. The authors defined treatment failure as recurrence of the abscess, need for colostomy, or emergency surgery within 4 weeks. The average abscess size was 6 cm. Of the 11 patients who were treatment failures, 10 (88%) required a colostomy. There was also a 33% mortality associated with treatment failure.<sup>16</sup> A similar case-control study compared treatment failure of patients treated with percutaneous drainage ± antibiotics and antibiotics alone. The matching process was not described. Treatment failure was defined as recurrence of the abscess within 4 weeks, need for colostomy, or need for emergency surgery. The rates of emergency surgery (30 vs. 16%) or mortality (9 vs. 3%) were not different ( $p > 0.05$ ).<sup>17</sup>

Abdominopelvic abscess occurs in 7 to 28% of patients with Crohn disease.<sup>18,19</sup> Historically, these abscesses would have been treated with an operation resulting in bowel resection and possible stoma creation.<sup>18</sup> Percutaneous drainage has become a first-line treatment for intra-abdominal abscess in patients with Crohn disease.<sup>20</sup> Drain placement is a temporizing measure to allow improvement of patient's nutritional status, and control local sepsis, which ultimately may decrease surgical complications.<sup>20</sup> The success rate for treatment of patients with a percutaneous drain ranges from 50 to 65%.<sup>18,19,21</sup>

Anastomotic leak is a dreaded complication of colorectal surgery. The mortality of anastomotic leaks can be as high as 12%.<sup>22</sup> There is also significant associated morbidity with reoperation for an anastomotic leak. Nonoperative management of anastomotic leaks with percutaneous drainage has been proven to be successful in selected patients. The success rate of CT-guided percutaneous drainage for colonic anastomosis leaks has been reported at roughly 80% although significant selection bias is inherent in this statistic.<sup>7</sup> For rectal anastomoses, treatment of anastomotic leaks with percutaneous drainage is less successful (roughly 48% in one study).<sup>6</sup>

Intra-abdominal abscess is a common occurrence after colon and rectal surgery. Often, these abscesses can be managed nonoperatively with placement of a percutaneous drain.<sup>23</sup> In 2002, Khurram Baig et al performed a retrospective study that examined 40 patients who underwent computed tomography- (CT-) guided drainage of intra-abdominal abscess that occurred after a variety of colorectal surgical procedures. Among the 40 patients, 65% had a complete resolution of their abscess with one attempt at drainage. Another 35% required repeat drainage with another catheter. Of the 40 patients, only 6 ultimately required laparotomy for treatment of the postop abscess.<sup>23</sup> This study suggests that postoperative abscesses can be safely treated with percutaneous drainage in patients who are hemodynamically stable and do not have peritonitis.

### Drains as a Risk Factor for Infection

Surgical-site infections (SSIs) are a major cause of increased length of stays and health care cost. Drains have been implicated as being a risk factor for the development of a surgical site infection. In 2001, a prospective single center study from Taiwan reviewed the cause of surgical site infections in 2,809 patients. Although they reviewed a large number of factors, they did conclude that the presence of a drain after elective surgery for colon or rectal resection was a risk factor for developing a surgical site infection. The study found that 3.8% of patients with a drain had an infection of their surgical incision. The authors concluded that a drain acted like a foreign body and increased the risk of surgical site infection and potentially anastomotic leak.<sup>24</sup> This study is subject to selection bias because patients with at high risk for SSIs are more likely to have a drain placed intraoperatively.

Other studies have established that surgical drains can harbor significant pathogens including methicillin-resistant *Staphylococcus aureus* (MRSA). One study documented a decrease in the percentage of drains with a positive culture when patients were treated with prophylactic first-generation cephalosporins. However, the authors did not demonstrate a difference in SSIs.<sup>25</sup>

### Conclusions

The use of drains after colorectal surgery has evolved over the last several decades. The use of prophylactic drains in intra-peritoneal colonic surgery is not supported by data

demonstrating improvement in outcomes related to anastomotic leak or other common surgical complications. Prophylactic drainage of the pelvis after complex pelvic surgery may decrease the development of pelvic collections; however, it is not clear whether drains influence the rates of anastomotic leak.

The technical feasibility and safety of postoperative percutaneous drainage of pelvic or abdominal collections has been demonstrated. Percutaneous drainage plays an important role in the management of several disease processes such as diverticulitis or Crohn disease. Management of selected patients with anastomotic leaks with percutaneous drainage is also possible. As in any field of inquiry with multiple conflicting data sources, the decision to drain or not to drain will largely be an individualized choice based on surgeon preferences and patient factors.

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