Colonic Anastomotic Leakage

Subjects: Others

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Although surgeries involving anastomosis are relatively common, anastomotic leakages are potentially deadly complications of colorectal surgeries due to increased risk of morbidity and mortality. As a result of the potentially fatal effects of anastomotic leakages, a myriad of techniques and treatments have been developed to treat these unfortunate cases.

Colonic Anastomotic Leakage,colectomy,colon resection

1. Introduction

Gastrointestinal surgery encompasses treatments for diseases of parts of the body involved in digestion, including the mouth, esophagus, stomach, small and large intestines, liver, pancreas, gallbladder, and anus. However, given that a large percentage of incidences of anastomotic leakage occurs in the area of the gastrointestinal tract involving the colon, this entry focuses on colonic anastomotic leakage and treatments thereof [1]. Many of the following treatments, however, can also be applied to related regions of the system, such as the ileocolic and the rectum.

A colectomy, or a colon resection, is a surgical procedure to remove all or part of the large intestine to treat or prevent diseases and conditions that affect the colon. These conditions may include cancer, bowel obstructions, diverticulitis, and Crohn’s disease. In the past, open colectomy was considered to be the cornerstone operation, however, in recent years, less invasive laparoscopic colectomy has become more popular [2]. One of the deadliest complications of these surgeries is anastomotic leakage (AL), a major cause of postoperative mortality and morbidity. Following operations involving colonic resection, an artificial connection must be made through a procedure called anastomosis, which can lead to anastomotic dehiscence or AL, which has been reported in the literature to occur with varying rates depending on the type, technique, and site of surgery among others (Table 1). While, in historic studies, leak rates of up to 30% were reported [3], more recent studies have suggested rates under 3% [4]. Colonic anastomotic leak is defined as a “leak of luminal contents from a surgical join between two hollow viscera” [5]. In the case that the luminal contents were to leak out into the abdominal area, patients could experience fever, abscess, septicemia, metabolic disturbances, or multiple organ failure [5]. This can increase the need for reoperation, risk of local recurrence, increase morbidity and mortality, and can generally have a greater impact on the quality of life [6][7].

Table 1. Reported rates of anastomotic leakage of different studies.

Reported Leakage Rate	Topic of Comparison or Study	Year Published	Reference
3.4–6%	Clinical colorectal surgery	2004	Chambers et al. [8]
1–30%	Anastomotic dehiscence	2009	Kingham et al. [3]
3–8%	Large bowel resection, colorectal cancer, left colon	2012	Oprescu et al. [9]
2.5–12%	Laparoscopic colorectal surgery	2010	Goriainov et al. [10]
2.7%	Population-based, retrospective cohort study	2017	Nikolian et al. [4]

AL has been a continuous problem in intestinal surgery for over a century. Various surgical techniques and prevention methods have been developed in the last few decades to contain these leakages [1]. Unfortunately, it seems that AL will continue to be a complication into the foreseeable future. There are several factors that describe an anastomosis. These factors include the orientation of the bowel, which dictates whether the anastomosis is side to side, end to end, or end to side; the technique used, which are handsewn and stapled; and the number the layers present, which is single or double layers [11].

Wound healing also plays a major role in a successful anastomosis. Therefore, AL is likely to occur when anastomotic healing is disrupted, even if the surgical procedure was conducted without flaws. It should be noted that wound healing in the gastrointestinal tract is different from that of cutaneous healing and is not yet fully understood [12]. The bowel wall of the colon consists of four layers, i.e., the mucosa, submucosa, muscularis propria, and serosa. Among these four layers, the submucosa, consisting mainly of collagen and elastin fibers, has historically been the most important layer in wound healing as it is the layer with the highest tensile strength. Within the first three to four days after gastrointestinal surgery, fibroblasts from the submucosa become active and start to deposit collagen [12]. After five days, the new tissue has already gained the strength and resilience of surrounding healthy tissue. After approximately four weeks post-op, the reorganization of collagen is almost finished, and the wound healing is about 90% complete. Therefore, the highest risk for AL is during the first few days after surgery for healthy patients [12][13][14]. However, the role of the other layers should not be neglected, since they are also essential during the wound healing process. The serosa seems to be important in providing a matrix for fibroblasts, while the interaction between bacteria, mucus, and the mucosal layer also seems important to maintain homeostasis in which anastomotic healing can occur [12]. The formation of granulation tissue is also essential during normal wound healing, which includes fibrovascular tissue containing fibroblasts, collagen, and blood vessels [15]. Angiogenesis is crucial for the wound healing process because the wound needs to be supplied with oxygen, nutrients, and immune cells. Additionally, wastes must be removed from the injury site. New blood vessels and capillaries are usually formed within three days post-injury and ensure sufficient tissue perfusion. Additionally, capillary growth is necessary to restore normal gut function, which includes the transport of nutrients from the mucosa into the bloodstream. There are multiple risk factors that can potentially affect wound healing, such as age, smoking and alcohol abuse, and even bacteria, such as E. faecalis, which has been shown to be associated with increased rates of AL and has been shown to possibly be contained by poly-phosphorylated polymer ABA-PEG20k-Pi20 in recent studies [16][17].

2. Postoperative Management Techniques

2.1. Severity Grading of Leakage

A method of detecting the severity of AL is through leakage score. Symptoms such as fever, increased heart, and respiratory rate, increased urinary production, and agitation or lethargy can be easily detected by the patient. Additionally, a local physical examination can detect signs of ileus, gastric retention, and fecal dehiscence, which can further measure the severity of AL [18]. After a leakage score exam, the clinician may perform a radiological examination to locate and detail the nature of the AL. The assessment of the severity of AL is important, as it determines the postoperative management thereof, some of which are outlined in the following subchapters. To date, there are different scoring and grading systems to either predict, diagnose, or grade the severity of AL [19]. The colon leakage score (CLS), for example, was developed to predict AL based on patient-related and intraoperative risk factors [20]. In 2010, the International Study Group of Rectal Cancer proposed a definition and grading system for AL classifying AL into Grade A, B, and C. Grade A was defined as an asymptomatic leakage requiring no active therapeutic intervention [21]. Grade B was defined as a leakage that required active intervention without relaparotomy. Grade C was defined as a leakage that required relaparotomy. Grade A AL does not require any change in patient management. Grade B AL is managed through non-surgical intervention such as antibiotics and drainage. Grade C AL requires surgical intervention or the insertion of a stent. [22] Surgical intervention still remains critical in the management of Grade C anastomotic leakage goal to washout the colon and divert fecal matter [23].

2.2. Detection Techniques

Early diagnosis is critical to minimizing morbidity and mortality of AL. Currently, the most common methods for detecting AL are radiological techniques such as computerized tomography (CT) scan and water-soluble contrast enema (WSCE). However, the reliability of these methods depends on the location on the site of the anastomosis, the timing, and the expertise of the clinician. WSCE has conflicting evidence of its effectiveness with some studies reporting 52.2% sensitivity and a false-positive rate of 6.4%, while others have reported an 80% success rate as compared with the 14% detection rate of CT scans [24]. This difference was further widened in patients with a distal anastomotic leak, proving that WSCE may be more reliable when diagnosing low AL. However, the CT scans have proven to be more detailed, which highlights the importance of an experienced radiologist.

In recent years, biomarkers such as MMP-2/9 and acute-phase proteins, have gained attention and could develop into a promising and more accurate way to detect AL. In one study, through measuring white cell count, C-reactive protein, and procalcitonin, 95.4% of patients were correctly classified with a sensitivity of 90.9% and a specificity of 95.7% [25]. In another study with mice, MMP tracers were able to predict 71.4% of positive results and 66.6% of negative results [26]. However, the use of biomarkers will need further review and more rigorous testing.

2.3. Proximal Diverting Stoma

Proximal diversion is an operation to temporarily divert fecal matter to protect colonic anastomoses from pelvic sepsis or systemic illness. Although it does not prevent anastomotic leakage, it has been shown to mitigate the consequences of anastomotic leakage rate reducing the need for reoperation [27][28][29]. However, there are also several significant drawbacks to fecal diversion. Patients are subject to additional operations and may develop small bowel obstructions and acute kidney injury due to high stoma output, or a parastomal hernia. A study by Lightner et al. reviewed the role of temporary fecal diversion and concluded that diverting the stoma was significantly beneficial in patients undergoing low anterior resection, coloanal anastomosis, and ileal pouch-anal anastomosis. The authors also highlighted the importance of diverting stoma in immunosuppressed patients, since they are at the highest risk of anastomotic leakage. Despite many benefits arising from diverting fecal matter, it is very important that the surgeon weighs the risks and advantages of constructing a stoma [29].

2.4. Draining

The evidence regarding the effectiveness of draining is inconsistent. In a study done by Zhao et al., trans anal draining proved to be promising with draining by reducing AL rates from 7.8% to 2.5% [30]. However, due to having very few cases with about 80 participants in each group and less than 10 people developing AL or bleeding, the difference was not statistically significant. In a meta-analysis done over eleven random controlled trials including 1803 patients, prophylactic drainage proved to be ineffective. However, some surgeons use drainage to guide exudation to flow out of the abdominal cavity to prevent anastomotic dehiscence. Nevertheless, only one of 20 clinical prophylactic drainage cases were effective in preventing and detecting AL and only lured surgeons into a false sense of security [31].

2.5. Antibiotics

Antibiotics are commonly used as the first line of treatment and can be used in combination with draining or reoperation. Treatments usually consist of a broad-spectrum antibiotic with Gram-negative and anaerobic bacteria coverage [23]. Because of increasing multidrug-resistant organisms, such as Pseudomonas and Enterbacteriacea, multidrug combination therapies are becoming increasingly necessitated [32][33]. In general, abscesses less than 3 cm in size can be managed with antibiotics alone if the patient is stable [34].

2.6. Exclusion of Perioperative Non-Steroidal Anti-Inflammatory Drugs (NSAIDS)

There is growing evidence that non-steroidal anti-inflammatory drugs (NSAIDs) should be used with caution in the postoperative period. A meta-analysis has demonstrated that non-selective NSAIDs were associated with an increased risk of AL. In recent years, a retrospective cohort study of over 13,000 bariatric and colorectal operations has shown a 24% increase in the risk of AL associated with NSAID use. This association is attributable to nonelective colorectal operations where the leak rate was 12.3% in the NSAID group and 8.3% in the non-NSAID group [35][36].

While some studies have shown that there was an association between increased leakage rates and NSAIDs, there are also studies that have concluded that there was a correlation [37]. Furthermore, according to a meta-analysis of NSAIDs and AL, the researchers found that the data from clinical findings were flawed and could be describing pre-existing bias [38]. However, there is still concern regarding NSAID usage and AL.

2.7. Stenting

In recent years, endoscopic self-expanding metal stents (SEMS) have become widely used for colorectal surgical complications with a reported success rate of around 80–85%, according to systematic reviews. Stents vary in their silicone coverage, from uncovered to partial coverage to full coverage, and in material, either metal or biodegradable. Despite their reported success, some complications may arise due to the use to SEMS to treat AL, including stent migration, perforation, and hemorrhages. While promising, the use of stents is still under review as migrations of the stents is a common problem throughout many studies and operations [39][40].

2.8. Vacuum Therapy

Vacuum-assisted wound closure (VAC) therapy or endoscopic placed negative pressure therapy has been shown to be very promising in treating AL. It promotes the healing of wounds by enhancing the formation of granulation tissue, reducing oedema, increasing vascularity, and decreasing bacterial colonization [23][39]. In a study by Weidenhagen et al., 29 out of 34 patients with AL following resection reported successful treatments with VAC therapy [41]. Kuehn et al. also reported a success rate of 88% out of 41 patients [42].

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