Anastomotic Leak After Colonic Resection

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CASE SUMMARY: A 73-year-old woman with right colon cancer and no distant metastases underwent a laparoscopic right hemicolectomy. She had a past medical history of treated hypertension and obesity, with a BMI of 32. Intestinal continuity was restored by a stapled functional end-to-end anastomosis. The anastomosis was under no tension, there was no intraoperative contamination, and the bowel ends were well vascularized.

The patient was progressing well on day 3 postsurgery. On day 4 she developed an ileus and right-sided abdominal pain, new-onset atrial fibrillation with a heart rate of 140 beats per minute, and a blood pressure of 130/60 mm Hg. Her abdomen was generally tender, and her C-reactive protein (CRP) was 180. A CT of the abdomen and pelvis showed free fluid and air, and contrast was shown to be leaking from the anastomosis. She was taken to the operating room, where a defect in the anastomosis was found, along with feculent peritonitis. The anastomosis was taken down, an end stoma created, the abdomen washed out, and she was transferred to the intensive care unit.

CLINICAL QUESTIONS

- What are the risk factors that increase chances of anastomotic leak?
- How should clinical findings, blood tests, radiology, and biomarkers be used to make an early diagnosis?
- What are the classification and management of anastomotic leak?

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BACKGROUND

In this article, we have focused specifically on anastomotic leakage (AL) after colonic surgery. AL after colonic surgery is a dreaded complication. The AL rate after colectomy is ≈5% to 6%.[1] It is associated with significant mortality and morbidity and is also the leading cause of death after colonic surgery.[2] There is no clear agreement on a definition for AL, but for the purpose of this discussion, *AL* is defined as a breakdown in the surgical join between 2 hollow viscera, with or without active leak of luminal contents.[3]

PRESENTATION AND DIAGNOSIS

Symptoms and signs associated with AL are not easy to differentiate from other postoperative infections. This makes it difficult to diagnose AL based on clinical signs alone. However, it is important to be able to recognize these signs in patients who have undergone an anastomosis.

AL is not usually clinically apparent before day 3 postoperatively and may present days or weeks after surgery.[4] AL usually produces a systemic inflammatory response, but this is by no means specific for its diagnosis.[4] Signs that help with the diagnosis of AL include peritonitis, higher than expected inflammatory markers, new-onset atrial fibrillation, and ileus.

Risk Factors

A systematic review by McDermott et al[2] of 451 articles identified risk factors that contributed to the risk of AL. These can be divided into preoperative, operative, and postoperative risk factors.

Men have been shown to have a higher risk of developing AL than women. A history of underlying disease, including diabetes mellitus, vascular disease, renal disease, and immunosuppression, all increase the risk of AL.[2] Emergency surgery is an additional risk factor.[2] Most preoperative risk factors are not modifiable, but adjustable risk factors include smoking, obesity, alcohol, and medications such as immunosuppressants and chemotherapy.[2]

Intraoperative risk factors include operative techniques. Kingham and Pachter[2] compared sutured anastomoses versus stapled anastomoses. They reported higher rates of radiological leaks when using sutures compared with staples, but no difference in clinical leaks was iden-

tified.[2] Increased tension on the anastomosis and poor blood supply to the colon increase the risk of AL.[3] Leak testing of left-sided colonic anastomosis is used to test any defects of the anastomoses intraoperatively. However, the majority of AL occurs despite negative leak testing.[5] A restrictive fluid regimen probably lowers the risk of AL. Inotropes are associated with a tripled increased risk in AL irrespective of the patient's medical background. Blood transfusion during the procedure is also a risk factor.[2]

Postoperative risk factors include the type of analgesia used after the operation. The role of nonsteroidal anti-inflammatory drugs in AL is unclear.[2] A number of retrospective studies have suggested a higher rate of AL in patients who received nonsteroidal anti-inflammatory drugs postoperatively.[6] Based on this, some have recommended that they not be used in patients undergoing colorectal surgery, but this is by no means certain.[6]

Investigations and Diagnosis

One of the most studied makers is CRP. CRP levels are raised 1 to 2 days before the diagnosis of AL.[7] A systematic review and meta-analysis of 7 studies with a total of 2483 patients showed that the concentration of serum CRP measured on day 3 to 5 after colorectal surgery is a useful negative predictive test but is not otherwise a particularly good diagnostic test for AL.[7] Other biochemical markers include markers for ischemia, such as pH and lactate, but these are not specific to AL.[8]

Procalcitonin is also another marker that is potentially useful at day 3 to 5 after the operation.[8] However, it is not a routine blood test and experiences the same problem as CRP because it is quite sensitive but not specific enough to be used in diagnosis.[8] In broad terms, these markers are better at ruling out AL than diagnosing it, because their positive predictive values are much lower than their negative predictive values.

CT remains the most commonly used modality used for the detection of AL. However, not all leaks are detected on CT, and clinical acumen remains crucial.

MANAGEMENT

Management of AL after colectomy depends on a variety of factors. These include but are not exclusive to age, comorbidities, current clinical status, reason for operation, and grade of leak.[9] AL can be classified into grades A, B and C; each grade has implications for clinical management.[9]

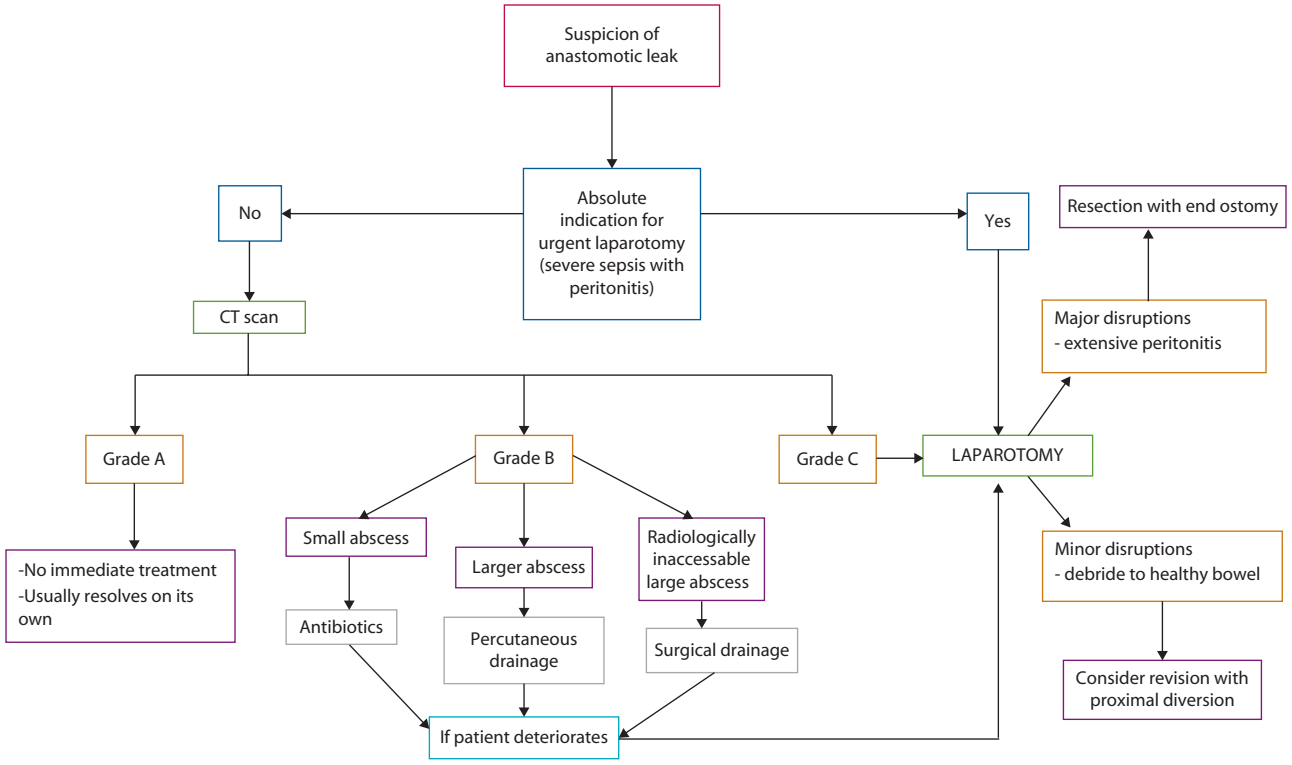
Grade A is radiological leakage. This grade is not associated with abnormal blood tests, and the patient is clinically well. This is not a common scenario after colectomy and is usually seen after anterior resection on a contrast enema before ileostomy closure. These usually do not require any active management and tend to spontaneously heal.[10]

Patients with grade B leaks usually have signs of low-grade sepsis with localized peritonitis and require cross-sectional imaging.[11] When a localized collection is present, management will depend on the size.[11] Small abscesses (<3 cm) can be managed with intravenous antibiotics with aspiration of the abscess if possible. If larger or multiple abscesses are present, then treatment will depend on the patient's clinical condition.[11] CT-guided drainage with an interventional radiologist may be considered, but if the abscess is difficult to access or if the patient continues to deteriorate, then operative management will be necessary.[11]

Grade C AL is the most feared form of AL after colectomy and requires operative management with the aim of controlling life-threatening sepsis.[9] These patients are typically septic, with increasing abdominal pain, peritonitis, and altered bedside parameters with significantly elevated inflammatory markers despite appropriate resuscitation.[9] The surgical procedure will depend on intraoperative findings. If a major defect is seen (a defect >1 cm or 1/3 circumference of the anastomosis) and evidence of ischemia is present, then complete takedown of the anastomosis with formation of an end stoma is the preferred treatment. Some surgeons may prefer to refashion the anastomosis with a proximal diversion.[11] In select circumstances, a grade C leak with a small defect where there is minimal to no fecal contamination may be managed laparoscopically.[12] This is described by Phitayakorn et al[11] in a standardized algorithm for the management of AL.

The algorithm for treatment is based largely on expert consensus with little in the way of clinical trials to justify the stance. Factors mentioned above will come in to play when deciding which procedure to use, but ultimately the decision for treatment will depend on the expertise and experience of the treating clinicians.

EVALUATION AND TREATMENT ALGORITHM



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Expert Commentary on Anastomotic Leak After Colonic Resection

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Drs Tutone and Hill present an excellent review of the presentation, diagnosis, and subsequent management of anastomotic leaks after a colectomy. This review should be mandatory reading for all surgeons who perform colon and rectal surgery. A leak is obviously the most dreaded complication following a colectomy and mandates quick recognition and treatment. Left untreated or, more insidiously, undertreated, the patient will rapidly become septic and die. The authors have described several preoperative, intraoperative, and postoperative risk factors, but I would like to expand on some of these and include my own pearls.

Preoperatively, there are several modifiable risk factors. Obviously, patients with cancer cannot wait months for an operation, but many other colorectal procedures can be postponed until the patient is appropriately optimized. Nutritional factors are a key component of tissue healing, including the intestinal anastomosis. Obtaining baseline parameters such as albumin, prealbumin, and transferrin levels and evaluation of sacropenia via a CT scan can provide an excellent snapshot of an at-risk patient's nutritional state. Total parenteral nutrition or tube feeds until the patient is in an anabolic state, as evidenced by a rising prealbumin level, may turn a highly risky anastomosis into relatively safe procedure. Conversely, morbidly obese patients have a significantly higher risk of an anastomotic leak because of the technical difficulties of the operation, as well as many of the medical issues associated with obesity such as diabetes mellitus. We obtain hemoglobin A1C levels routinely in our elective patients, and refer patients with uncontrolled diabetes mellitus to endocrinology for optimization. Also, over the past few years, I have sent morbidly obese patients (BMI>45) to our bariatric surgeons who perform a sleeve gastrectomy, and these patients return to see me after 6 months. They routinely lose 70% of their excess body weight and turn a hazardous and difficult procedure into a routine one. I use this algorithm frequently in young obese patients with diverticulitis.

In addition to nutrition, the patient's immune system is often impaired in our patient population. Our IBD patients are often on a host of immunosuppressive agents, including anti-tumor necrosis factor-α agents. Although the literature is unclear regarding the effects if these agents on surgical complications, I wait 4 to 6 weeks after their last infusion of these drugs before an elective procedure. I have the same recommendation for systemic chemotherapy. Patients with HIV have their CD4 counts and viral loads checked before an elective procedure. If they are not optimized, I ask our infectious disease specialist to help with management of their antiviral therapies before surgery.

The final preoperative factor that may play into an anastomotic leak is the use (or nonuse) of a mechanical bowel preparation with oral antibiotics. The pendulum has clearly swung back in favor of these preparations, not only to reduce surgical site infection, but also to reduce leaks. Provocative data from Dr John Alverty's laboratory on the gut biome also supports this on the basic science level.

Intraoperatively, surgeons should follow basic tenets of bowel anastomosis without exception. Specifically, a tension-free anastomosis is critical. Sigmoid colectomies usually require the mobilization of the splenic flexure. I also disconnect the omentum from the distal transverse colon and divide the inferior mesenteric vein to allow the proximal colon to fall easily into the pelvis. Transverse colectomies can be particularly vexing. Options for a tension-free anastomosis here include mobilizing both the hepatic and splenic flexures or performing an extended right hemicolectomy. It is my usual technique to add suture reenforcement to the stress point of the anastomosis (eg, at the apex of the linear staple line and the common enterotomy closure site). Avoiding anastomosing an ischemic portion of bowel is also critical. Identifying and preserving the marginal artery is mandatory. I often divide the marginal artery sharply and observe for arterial bleeding before construction of the anastomosis. In addition, the intraoperative use of indocyanine green dye can be particularly helpful to identify any questionable areas. In-

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docyanine green is now available on all platforms including open, laparoscopic, and robotic procedures. Finally, if a particularly risky anastomosis is performed, the most prudent advice is to divert the patient proximally with a loop ileostomy. Preventing or mitigating the consequences of a leak is preferable to having an ileostomy for 3 months.

Postoperatively, if a leak is suspected, immediate action is required. I do not believe that a CT scan needs to be performed on postoperative patients that are hypotensive, tachycardic, and oliguric. If these patients have peritoneal signs, they need to return emergently to the operating room for a wash-out and proximal diversion. Needlessly waiting for a scan will ensure a rapidly escalating septic state. Nonoperative management of a leak (grade B) can be useful in the stable patient. Abscesses can be percutaneously drained and antibiotics tailored to the bacterial contamination. However, this requires exceptionally close examination of the patient for any clinical deterioration. In addition, the patient usually requires several subsequent CT scans to ensure effective drainage of all fluid collections.

In conclusion, colonic anastomotic leaks are the most feared complication after colon surgery. It is paramount to optimize the patient preoperatively and to adhere to sound surgical dictums in the operating room. If a leak develops, prompt return to the operating room for a proximal diversion is the safest option.

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