Enterocutaneous Fistula: Medical and Surgical Management Including Patients with Crohn's Disease

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ABSTRACT

Patients with inflammatory bowel disease (IBD) and especially Crohn's disease can be challenging for even the most seasoned of surgeons. Development of an enterocutaneous fistula (ECF) in these patients further adds a level of complexity that requires a well-planned and defined management strategy. The role of the surgeon in caring for these patients should be as the leader of a multidisciplinary team, directing the care of the other specialists, all while determining if, and when, the patient requires operative intervention. Although medical management has come a long way in these and similar patients, surgery is still needed in a vast majority of patients. Therefore, understanding the evaluation, initial management, and important technical considerations for care of IBD and other complex patients with ECFs is a difficult, yet much needed, task for which the surgeon should be prepared.

KEYWORDS: Enterocutaneous fistula, inflammatory bowel disease, Crohn's disease

Objectives: Upon conclusion of this article, the reader should have a thorough understanding of the medical and surgical principles for managing enterocutaneous fistulas (ECFs) including: (1) the importance of a multidisciplinary approach; (2) early management of ECFs; and (3) the unique challenges patients with underlying inflammatory bowel disease provide.

Enterocutaneous fistulas (ECFs) are abnormal connections between the gastrointestinal tract and the skin. The majority (~85%) of ECFs develop following abdominal surgery for intestinal malignancy, inflammatory bowel disease (IBD), recurrent explorations, or after extensive adhesiolysis for conditions such as small bowel obstruction. The remaining ~15% form *spontaneously* secondary to IBD (Crohn's disease >indeterminate colitis >ulcerative colitis), radiation enteritis, diverticular disease, perforated malignancy, intraabdominal sepsis, and abdominal trauma. Although the origin of the ECF can be essentially anywhere along the gastrointestinal (GI)

tract, they most commonly arise from small bowel, colon, stomach, and duodenum in decreasing order.^{1,2}

As spelled out elsewhere in this issue, the management of the ECF requires a multidisciplinary approach, which will often necessitate aggressive medical and surgical management to try to minimize morbidity and mortality. This is especially true in those patients with underlying inflammatory bowel disease, where the potential for a lifetime of disease recurrence and future function must always be considered. Despite the wide range of underlying causes and patient clinical presentations, some basic tenants must be adhered to

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in all patients with ECF to maximize outcomes for this very challenging and compromised patient population. Improvements in outcomes have been shown with early control of sepsis through volume resuscitation, correction of metabolic and electrolyte abnormalities, intravenous (IV) antibiotics, and percutaneous drainage of intraabdominal abscesses. In addition, appropriate aggressive wound management and skin protection, nutritional support that often utilizes both parenteral and enteral routes, control of fistula output, and appropriate surgical intervention are routinely required. Despite early and accurate implementation of all these facets, the mortality rates are still high with ECF management, ranging from 5 to 29% overall, and surgical mortality reported in 3 to 3.5%.³ As such it is important to not only be aware of the technical aspects of surgically managing these patients, but also to recognize the role that the surgeon plays as the leader of vast team of experts to coordinate the care and optimize the patient as much as possible prior to heading to the operating room.

This multidisciplinary approach requires a team of specialized individuals including the surgeon, gastroenterology and infectious disease specialists, an interventional radiologist, and a therapist, as well as a dedicated ancillary unit of specialized nurses, a dietician, a pharmacist, and a case management worker. ECFs are, in my opinion, a surgical disease first and foremost; the surgeon should direct all aspects of the patient's management, with input from a gastroenterologist especially crucial for medication management of patients with underlying IBD. There must be a wound ostomy nurse who can spearhead the management of the external fistula site, to control associated injury to the surrounding skin or any exposed bowel. They must often be very creative with construction of wound appliances to instill in the patient and the associated nursing staff confidence and control of the GI effluent, which can be up to liters each day. Even the most experienced of enterostomal therapists will often be faced with situations that are extremely challenging and "not covered in the book." Patients with underlying Crohn's disease may have multiple external openings, bridges of intervening healthy skin, and prior abdominal scars that make proper pouching extremely difficult. In situations like these, it cannot be emphasized enough the importance of relying on previous encounters, ideas from peers, along with simple trial and error to find out what works. Though covered more extensively elsewhere in this issue, the use of a wound vacuum-assisted closure system (V.A.C., Kinetics Concepts Inc., San Antonio, TX) has become an invaluable tool for the management of patients with large abdominal wounds, providing both skin protection and accurate quantification of effluent output.⁴ Even in patients with exposed bowel, the use of the V.A.C., albeit somewhat controversial, in my experience has allowed for a level of management not seen in as short a time as 10 years

ago. These devices have allowed patients with ECF more independence, freeing patients both from the hospital bed, and in many cases, inpatient requirements. Wound ostomy nurses play a crucial role in the management of this patient population by controlling associated skin excoriation, and allowing a more precise measurement of the daily output from the ECF, which surgeons can use to calculate daily fluid requirements. Overall, their management has allowed patients more confidence and mobility than ever before. Additionally, although often overlooked, the patient with an ECF has to have psychological support, as this is a devastating illness that will frequently require lengthy hospitalizations, home parenteral nutrition, and wound management. In addition, clinical setbacks requiring readmission, waxing and waning ECF output, and disease recurrence especially in those with IBD are not uncommon. This can take a toll mentally on even the most stoic or hardened of patients. Early recognition and counseling, which can last up to 6 months or longer, is paramount to optimal patient care. Therefore, I highly recommend and commonly enroll the help of a trained professional therapist with these patients early in their course.

DEVELOPMENT AND EARLY MANAGEMENT OF ENTEROCUTANEOUS FISTULA

As stated, an ECF may develop from a wide variety of sources and settings. The clinical presentation of patients who develop postoperative sepsis and ultimately an ECF—secondary to an anastomotic leak, an attempt to repair a failed enterotomy or stricturoplasty in IBD patients, or free spillage of an unrecognized enterotomy—varies. Furthermore, the role of the surgeon and ancillary providers in the management of each of these situations also varies. Therefore, I will describe the three most common presentations based on my clinical experience.

In the first scenario, in the immediate postoperative period, and most commonly in the first 3 to 7 days postbowel resection, the patient will begin showing signs of sepsis that include elevated temperatures, tachycardia associated with fluctuations in blood pressure, elevated white blood cell count, and progressively distended bowel with either localized or generalized tenderness. At this point, I prefer to perform a computed tomography (CT) scan of the abdomen and or pelvis, with or without oral and IV contrast, in an attempt to localize an area of sepsis or fluid collection. Most patients at this point in their postoperative course cannot drink oral contrast and they may require placement of a nasogastric tube for passage of the contrast through the stomach into the small bowel and colon. With the identification of a localized fluid collection concerning for an abscess, the interventional radiologist plays a more prominent role

with the potential ability to place a percutaneous drain for source control. Importantly, I have found it to be extremely beneficial to speak to the radiologist about drain site placement ahead of time (i.e., transgluteal, abdominal). This is secondary to if and when the ECF does develop, proper drain placement could facilitate management of the effluent, when possible, on a readily accessible and reliable site of the abdomen. On the other hand, a poorly positioned drain site can compound an already difficult situation, and perhaps lead to more problematic wound care or even more extensive surgical needs than anticipated.

I have also encountered a second early ECF presentation in which the patient, in a similar 3- to 7-day postoperative period, is found to have generalized peritonitis manifesting with hypotension, tachycardia, low urine output, acidosis, pulmonary compromise, and elevated white blood cell count. Some patients such as those with missed enterotomies or free-flowing spillage may present even earlier. More concerning, those with underlying immunocompromised states such as IBD patients on steroids or immunomodulators may present with a paucity of abdominal findings. However, all these patients require immediate transfer to the surgical intensive care unit (ICU) or even the operating room for immediate resuscitation including aggressive fluid replacement, broad-spectrum antibiotics, cardiac monitoring, and sometimes pulmonary support. This is often the most difficult patient to evaluate, although the surgeon must realize this patient has abdominal sepsis and early surgical intervention is frequently critically important. Whether the patient requires a CT scan or aggressive fluid resuscitation and immediate surgical intervention is a personal decision by the surgeon that is based on the patient's clinical condition and the experience of the surgeon. However, I do not believe that a surgeon who "clinically" believes that the patient has postoperative abdominal sepsis can be nor should be criticized for taking the "resuscitated" patient back to the operating room to attempt to control the source of the sepsis without a preoperative CT scan. Similarly, there is no better arena to maximize resuscitation needs than the operating theater, and transfer to the ICU may be an unnecessary step that should be altogether avoided. After the decision has been made to return the patient to the operating room, the surgeon is often confronted with one of the most technically challenging abdominal surgeries, complete with corresponding high morbidity and mortality rates. Though not present in every situation, certain points should be kept in mind when confronted with this scenario.

Upon opening the abdomen, there is often some turbid fluid, bile, or stool that is coating the bowel. The small bowel is usually matted together, covered in exudate, and very granular in appearance. Caution is of utmost importance, as this is very tenuous, friable bowel,

Figure 1 Enterocutaneous fistula opening into a midline wound. (Courtesy of Eric K. Johnson, M.D., Department of Surgery, Eisenhower Army Medical Center, Ft. Gordon, GA.)

and minimal surgical dissection should be performed. Copious warm water/saline irrigation may help in breaking up some of the loculations, allowing easier entry. In the case of a postoperative leak, the surgeon knows where the anastomosis lies, and should realize up front that it may be difficult, if not impossible, to gain access to that area to either resect the anastomosis and construct an ostomy, or divert with a portion of bowel proximal to the anastomosis. In addition to the copious irrigation, this type of abdomen will require midline wound control with either an open abdomen or placement of a V.A.C. device (Figs. 1–4). Unless the anastomosis is in the pelvis or is an ileocolic anastomosis that is draining into the pelvis, I will not routinely place a drain or multiple drains throughout the abdomen to assist with drainage or control of effluent from the bowel. On the other hand, focused drain placement for an obvious source may be beneficial. However, the last thing a

Figure 2 V.A.C. (Kinetics Concepts Inc., San Antonio, TX) fashioned to aid in stomal device application over the enterocutaneous fistula. (Courtesy of Eric K. Johnson, M.D., Department of Surgery, Eisenhower Army Medical Center, Ft. Gordon, GA.)

Figure 3 V.A.C. (Kinetics Concepts Inc., San Antonio, TX) applied to open abdomen with enterocutaneous fistula on the right. (Courtesy of Eric K. Johnson, M.D., Department of Surgery, Eisenhower Army Medical Center, Ft. Gordon, GA.)

Figure 4 Stomal pouch applied over V.A.C. (Kinetics Concepts Inc., San Antonio, TX) and enterocutaneous fistula. Notice the ability to quantify output and provide skin protection. (Courtesy of Eric K. Johnson, M.D., Department of Surgery, Eisenhower Army Medical Center, Ft. Gordon, GA.)

surgeon should do is compound the problem by dissecting through already compromised bowel and potentially introduce enterotomies or enterotomy repairs that may become ECF due to their inability to remain closed. Rather, the patient will eventually begin draining bile or stool through the wound where it can be managed better as the systemic sepsis is managed and stabilized.

The final scenario involves patients who are 7 to 10 days or later after their initial operation (i.e., late postoperative ECF), where the patient presents with a tender, erythematous, fluctuant area in the midline incision or port site. Following opening of the skin and initial expression of fluid, the wound is normally packed with wet to dry saline gauze. Unfortunately, within the next 24 hours, the patient or a nurse will note that the wound drainage looks like bile or stool—pathognomonic of an ECF. In this latter case, the patient is generally not

as ill, as the ECF is following a well-delineated and controlled tract to the wound. However, this remains a crucial time for the overall wellbeing of the patient, and a logical stepwise plan should ensue. Initially, I prefer to keep the patient off oral intake (NPO), place central access to begin parenteral nutritional support, and consult enterostomal wound therapy for skin protection. Although in many cases the patient by this point is already being treated for sepsis with antibiotics and fluid support, my experience is they usually are clinically stable and do not have signs of systemic sepsis.

MANAGEMENT OF ENTEROCUTANEOUS FISTULA

Following initial sepsis control in any of the above three clinical presentations, the management of the ECF can be somewhat standardized from this point on. Depending on the degree of physiological insult or the underlying disease, in-depth details are available in other articles in this issue. Some generalized points are worth additional emphasis. First, the patient's intake and output must be meticulously monitored and documented by the nursing staff. Any volume and/or electrolyte imbalance must be corrected with appropriate mineral and crystalloid solutions—especially sodium, potassium, magnesium, and other trace elements. Severe anemia should be addressed with blood transfusions as indicated, while any folate or iron deficiency can be replaced with appropriate supplementation. The patient's body mass index must be calculated to infuse the proper caloric and protein intake. Early nutrition support is a crucial component in the management of ECF; as patients will develop a requirement to balance glucose, lipid, calories, amino acids (excluding glucosamine), trace elements, fat, and water soluble vitamins. Glucosamine is believed to decrease permeability of small intestinal cells, and has shown some promise in early animal models to lower the fluid losses in ECF patients.⁵ Most patients have prior starvation for at least 5 days so parenteral nutrition is introduced in 25% intervals until maximal caloric intake is achieved. Usually patients require 1 gN per every 150 kcal, although this ratio may change as the patient's overall condition and response to the nutrition evolves.⁶ Patients with underlying IBD are often malnourished and plagued by chronic diarrhea and wasting, and may have increased nutritional requirements over and above the already elevated ones listed. As such, a metabolic cart for ventilated patients or formal nutritional assessment is often helpful to not only guide replacement therapy, but avoid overfeeding as well.

Central line placement, whether tunneled or percutaneous (temporary catheter), is routinely performed by a physician or specialized team of nurses. The catheter should only be used for the administration of total parenteral nutrition and not for blood transfusions or

blood drawing. Strict adherence to aseptic techniques is paramount, including daily inspections and dressing changes, as sepsis is a major cause of morbidity and mortality in this patient population. In fact, although sepsis may be secondary to recurrent abdominal infection, line sepsis should always be kept in mind with any worsening of the patient's clinical condition. Special attention should be given for IBD patients on review of prior medications including current or recent past steroid use, as hemodynamic instability may also result from relative corticosteroid insufficiency secondary to adrenal suppression.

Control of the ECF output is especially important and often more difficult in the early phase of management because the fistula tract has not formed and the output is usually higher than later on in the "maturation" stage of the fistula. Fistula location also plays a prominent role, with more proximal fistula origins equating to higher output. The use of antidiarrhea medications and or in combination with octreotide can decrease the amount of ECF output, and facilitate better wound management. Although covered elsewhere in this issue, in my experience, the use of octreotide has been of value in at least one third of the patients to decrease output. However, I have not found that it has enhanced overall healing/closure of the ECF.

The introduction of oral intake should be instituted as soon as clinically feasible. The diet utilized depends, in part, on the anatomic site of the ECF. Attempts at different combinations of diet include high caloric nutritional drinks, and if necessary, nasenteric tube placement with other liquid nutritional supplements. As Drs. Lee and Stein detail in this issue, the anatomic site of the ECF can usually be determined by radiographic studies. Fistulography in my experience is the most valuable and my preferred initial study, although CT scans are also helpful in determining the presence of any surrounding inflammatory response or abscess formation that may also need to be addressed. As they also point out in their article, intestinal magnetic resonance imaging (MRI) has recently been utilized with success, and although expensive, may be helpful to determine better resolution or other problems of the associated bowel.

There are several factors that will help determine if an ECF will have a higher likelihood of closing on its own without the need for surgical intervention: absence of sepsis, distal obstruction, abdominal wall defect, or active inflammatory bowel disease (i.e., Crohn's disease). Those *not* associated with malignancy or radiation enteritis include ECFs with a low daily output (<500 mL/day), distal location, or single opening, and patients without malnutrition (serum albumin >3 g/dL) and those with intact intestinal continuity.⁷⁻⁹

When the surgeon has concluded that the ECF is unlikely to spontaneously close, the decision as to when

surgical intervention is required should be based on a clinical impression with consideration of the individual patient's nutritional status, absence of sepsis, and condition of the abdominal wound. My preference is to wait until the 3- to 6-month time frame following development of the ECF to allow for the acute inflammatory process to subside, when possible. My impression on the complex patient, such as those with a vast amount of abdominal spillage and resulting large open abdominal wounds, is they require longer intervals than those who had a less protracted hospital course prior to reembarking on operative intervention.

ENTEROCUTANEOUS FISTULA TECHNICAL ASPECTS

Surgical management of patients with ECF is often some of the most technically challenging situations, much more than many other major abdominal procedures. The technical difficulty is determined on not only the site of the fistula, but also on the patient's previous hospital course and amount of prior abdominal sepsis. I break down these patients into two categories. First is the patient with an anastomotic leak and localized sepsis that develops a more controlled/contained colocutaneous ECF (i.e., following low anterior resection or ileocolic resection). As these patients are not floridly septic, preoperative planning and optimization is key. I prefer a standard mechanical bowel preparation, complete with oral and IV antibiotics, along with bilateral ureteral stents to enhance ureter localization or recognition of an injury. For a low anterior resection dehiscence, the mobilization of the colon proximal to the anastomosis is very difficult and care must be taken to salvage the marginal artery to avoid having to rely on the transverse colon for the neoanastomosis should it be injured. A second critical aspect is the dissection and mobilization of the ECF origin at the prior colorectal anastomosis, which is fibrotic and usually fixed to the sacrum. Great care must be taken to prevent injury to the sacral veins while mobilizing the remaining healthy rectum in preparation of the neocolorectal anastomosis. If the patient does not already have a diverting ileostomy, I will normally utilize one temporarily to protect this anastomosis. In general, I avoid a loop colostomy due to the possibility of injuring the marginal artery either during construction or take down of the colostomy, which may further jeopardize the anastomotic blood supply. Additionally, a proximal transverse colostomy is often very difficult for the patient to manage, thus lowering quality of life in an already trying time.

The second scenario is the patient recovering from a protracted hospital course, usually with an open wound that was skin grafted or managed with a V.A.C. This patient has a large incisional hernia with densely adherent underlying small bowel in which peristalsis can often be visualized. In this case, gaining entry safely into the

abdomen is hazardous, and usually requires meticulous sharp dissection. It is advisable to start in the midline at a site that was not included in the original incision and work toward the incisional hernia. As it is often inevitable that an enterotomy is made requiring primary repair, preoperative maximization of nutrition status may help avoid future complications. Following local mobilization of the small bowel from the abdominal wall hernia sac, the resultant intra- and interloop adhesions are more amenable to dissection and separation. Although reaching the site of the anastomotic leak or previous enterotomy is tedious, it is manageable. I make every attempt to resect the ECF site (i.e., anastomosis, enterotomy, diseased bowel) and construct a new anastomosis. Despite careful and scrupulous attention, the overall failure rate following surgical management is ~10%.

SPONTANEOUS ECF IN INFLAMMATORY BOWEL DISEASE (CROHN'S DISEASE)

Despite only 15% of ECF developing spontaneously, this most commonly occurs in patients with underlying Crohn's disease. The remaining small percentage of patients is secondary to radiation enteritis, malignancy, or trauma. Crohn's patients may manifest in one or more of three basic phenotypes—stricturing, inflammatory, and fistulizing—with over 40% having a fistulizing component that can originate from the small bowel, colon, or anorectum. Small bowel disease including fistula are most commonly located in the ileocolic region. Importantly, unlike in other underlying disease, ECF with Crohn's disease often will not only involve the small bowel and skin, but also include another segment of the GI tract that will have to be dealt with at the time of surgery.

However, prior to embarking on operative treatment, maximal medical therapy is warranted in Crohn's patients. The medical management of patients with fistulizing Crohn's disease, in particular, has seen a marked improvement over the past 10 years with the addition of the biological medical therapy and immunomodulation.^{10–12} Monoclonal antibody therapy against tumor necrosis factor (TNF), such as infliximab, has been associated with the greatest success in fistula closure, with dosages ranging from 5 to 10 mg beginning with three dosages in the first 8 weeks followed by a maintenance regimen every 6- to 8-week intervals.¹² However, despite its success, over 50% of patients (abdominal >perianal) will eventually require surgical intervention and resection.¹³ Usually these patients have been managed by the gastroenterologist with bowel rest, total parenteral nutrition, control of sepsis, and medication. The patient is usually in good nutritional status and is ready for surgical intervention, though high-dose steroids and immunomodulators have been reported with higher postoperative complication rates.^{14–16} Radiological studies should be performed to determine the fistula anatomy and any

associated inflammatory response. In many patients a minimally invasive approach is feasible and safe, though has been associated with longer operative times, higher conversion rates, and increased stoma use for complex Crohn's patients including fistula.¹⁷

At the time of surgery, a small probe placed into the external opening will often allow better localization of the tract during the dissection of the bowel. Although I prefer a medial-to-lateral approach in both the open and laparoscopic approaches for lesions in the ileocolic region, the degree of inflammation will be the major determining factor. After isolating the ileocolic artery (ICA), visualization of the duodenum is the appropriate anatomical landmark to ensure this vessel is not the distal tip of the superior mesenteric artery. Once the duodenum is mobilized out of harm's way and ICA transection is complete, a retro-colic dissection (under the colonic mesentery) of the right colon, hepatic flexure, and the proximal transverse colon, along with full mobilization of the terminal ileum will ensure adequate mobility. The final step prior to an extracorporeal anastomosis is complete takedown of fistula-involved bowel segment off of the abdominal wall, which may be completed laparoscopically or via an open incision. Care at this final stage should be taken to avoid spillage of bowel contents.

SUMMARY

The management of ECF, especially in patients with inflammatory bowel disease, requires adherence to the basic principles of sepsis control, wound and skin care, nutrition optimization, fluid and electrolyte balance, psychological support, and case management both in the hospital and home health care. With all these various needs, the utility of a multidisciplinary approach cannot be overemphasized. Patients with Crohn's disease should undergo appropriate medical management, especially with the reported success of immunomodulators. Following failure to spontaneously close, the timing of surgical intervention should be based on the surgeon's assessment of the patient's clinical condition with consideration for multiple factors to optimize outcomes and minimize morbidity and mortality.

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