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The Art of Fistuloclysis: Nutritional Management of Enterocutaneous Fistulas

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Enterocutaneous (EC) fistulas, though relatively rare, are very challenging to manage. Multiple variables are used to define and classify EC fistulas, each of which must be considered in developing a treatment plan for these patients. There are no well-established clinical treatment guidelines that include nutrition or pharmacologic interventions for these patients. A case study is presented demonstrating the complexity of managing the EC fistula patient focusing on the nutritional management and the importance of a multidisciplinary approach.

CASE

In June 2009, a 40-year-old male was admitted to an outside institution after developing a partial small bowel obstruction secondary to multiple abdominal incisional hernias that required repair; recovery was complicated by the development of multiple intra-abdominal abscesses. His history was significant for a motor vehicle crash dating back to 2002 where he sustained multiple orthopedic and intra-abdominal injuries that required numerous surgical interventions. Before transfer to our facility, he underwent lysis of adhesions, repair of multiple hernias and resection of a loop of small bowel with a primary anastomosis after a bowel perforation. At this point he was admitted to our facility with a deep wound infection, necrotizing fasciitis and abdominal sepsis. On July 30th a laparotomy was performed for retroperitoneal abscess drainage and debridement of necrotic tissue due to abdominal wall infection.

On August 16th, a computerized tomography (CT) scan suggested enterocutaneous fistulas, and by August 25th the fistulas had epithelialized. One fistula drained significant volume indicating it was the more proximal fistula; the other drained scant mucous and was therefore deemed a mucous fistula. A fistulogram via the mucous fistula showed significant length of bowel above the ileocecal valve, no leaks or communications with the other more proximal fistula, and unobstructed flow to the large bowel. It was determined that the

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mucous fistula originated in the mid jejunum; a 14 French gastrostomy tube was inserted into this fistula and retained in place with a locking pigtail.

Throughout the course of therapy the patient received both parenteral nutrition (PN) and enteral nutrition (EN). With the exception of one unsuccessful attempt to enterally feed via a nasogastric tube, the patient was maintained on PN until EN was started via the fistuloclysis tube. PN was also administered perioperatively around the time of his fistula repair. In order to maximize fluid, electrolyte, and nutrient absorption, and to manage output to protect the skin around the fistulas, several medications were used. These included a proton pump inhibitor, anti-diarrheals and octreotide.

After working closely with a skilled wound ostomy continence nurse who had customized a system for pouching and feeding, the patient was discharged on September 22nd on nocturnal EN and a reinfusion schedule whereby output from the proximal fistula was infused into the distal fistula. He was advised to minimize his oral intake and to avoid solid foods that could clog his pouching drainage system. Periodically he required IV fluids and PN to supplement his EN due to increased GI losses.

The following year he had an operation to repair his fistulas. The surgery included 3 small bowel resections, 3 enteroenterostomies, a partial sigmoid colectomy with colocolostomy, massive lysis of adhesions, closure of the EC fistulas, and reconstruction of the abdominal wall.

INTRODUCTION

A fistula is an abnormal communications between two hollow organs or from an organ to the skin or wound. Fistulas from the bowel to skin or to a wound are called EC fistulas. EC fistulas can be subdivided into two categories: spontaneous and surgical (see Table 1). The majority of spontaneous fistulas are due to inflammatory bowel disease. Surgical causes account for the majority (up to 75%) of EC fistulas [1,2]. They are most often subsequent to surgeries which have higher likelihood of inadvertent enterotomy formation and/or anastomotic leakage such as lysis of adhesions, bowel resection for inflammatory bowel disease, and bowel resection for cancer [1–3].

Table 1
Causes of Enterocutaneous Fistulas (1–3)

Causes of surgical fistulas

- Lysis of adhesions/Enterotomies
- Bowel resection for IBD
- Bowel resection for cancer
- Surgery on radiated bowel
- Unprepped bowel

Causes of spontaneous fistulas

- Inflammatory bowel disease
- Diverticular disease
- Ischemic bowel
- Perforated ulcer
- Abdominal penetrating trauma
- Gynecologic malignancies

Management of patients with EC fistulas is extremely challenging and carries with it a high degree of morbidity and mortality with sepsis being the major cause of mortality in these patients. Prior to 1960 mortality was about 60% [4]. Mortality in the past fifty years has dropped most likely as a result of improvements in management of sepsis and possibly with improved use of PN and EN [5–7]. However, mortality remains high at 6–33% in the most recent case series [8–11].

Prior to the availability of PN, EC fistula patients received oral diet and/or enteral feedings [12]. However, once PN became easily accessible, it became more customary to allow "gut rest" in an effort to reduce fistula output and to nourish EC patients with PN. Currently, there are increased efforts to enterally feed when possible. The benefits include maintaining the health of the gastrointestinal mucosa that by anecdotal report improves the outcome after surgery for repair of the fistula [13,14]. Benefits also include reduced infection risk and cost [15].

Post-operative fistulas typically present within 7-10 days of the surgery. Initial presentation includes: elevated white blood cell count, fever, erythema, and cellulitis [16]. With 24 to 48 hours of this presentation,

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drainage begins at the site of the erythema. Initial management includes control of hydration and electrolyte status, sepsis control, *nil per os (as output is quantified)*, identifying the source of the fistula, usually administering PN as the diagnostic work-up continues [16]. Lal et al. describe the Sepsis Nutrition Anatomy Plan (SNAP) approach to managing intestinal fistula [17]. It includes first and foremost sepsis control, then nutrition support, definition of the anatomy of the fistula and finally, devising a plan.

After the initial work-up phase for the EC fistula during which the patient is usually fed parenterally, the decision regarding which route to use to feed patients with EC fistulas depends on several factors. These include: the origin of the fistula, the length of healthy, unobstructed bowel proximal and distal to the fistula, the likelihood of spontaneous closure and the volume of output of the fistula particularly in terms of the ability to manage the output to protect the surrounding skin. However, ultimately, if there is sufficient functional bowel for adequate nutrient absorption, if there is no ongoing intra-abdominal sepsis and fistula output can be managed such that adjacent tissue is protected, then efforts should be made to use the gut. Otherwise, PN is necessary and oral diet and/or EN should be minimized. If full nutritional needs cannot be met enterally, then supplemental PN should be used.

Given the complexity of managing EC fistula patients, a collaborative approach including multiple specialists is recommended [7,17–19]. The team should include: a physician, a nutrition support dietitian, a wound ostomy continence nurse, pharmacist, and a radiologist. All clinicians involved should have specialized knowledge and experience in managing these types of patients.

The challenge of managing these patients is accompanied by a substantial financial burden to the healthcare system and/or to the patients [3]. Further improvements in management of these patients could help reduce morbidity and mortality, as well as reduce healthcare costs. The purpose of this article is to examine the multiple factors that impact the management of a patient with an EC fistula originating in the small bowel. These factors include a detailed diagnosis of the fistula, ability to manage fistula output, as well as nutritional and pharmacological interventions.

CLASSIFICATION

There are multiple variables that are used to classify and determine the treatment plan for patients with EC fistulas. In fact, there are so many variables that classification of EC fistulas is difficult. No universally accepted classification system exists [6]. Nevertheless, detailed knowledge of the fistula is essential to determining its likelihood of spontaneous closure and the best treatment plan [6,16]. The etiology of the fistula, spontaneous versus surgical, is one way to classify fistulas. Another is to identify the details of the anatomy of the fistula. Typically the anatomy of the fistula is based on: its origin; whether there is a single tract or multiple tracts; and the presence or absence of obstructions distal to the fistula [6]. They are also classified by the volume of output per day, typically: >500 mL/day as high output and <500 mL/day as low output.

SPONTANEOUS CLOSURE

Ultimately the goal is for the EC fistula to close. Sometimes this occurs spontaneously. The rates of spontaneous closure vary depending on the case series cited. They range from 19% [20] to 70% [21]. The fistulas that are most likely to close without surgical intervention include: surgical etiology, free distal flow, healthy adjacent bowel, no abscesses, tract >2 cm and not epithelialized, low output and no co-morbidity [1,2,8,22,23] (Table 2). If spontaneous closure is to occur, it usually occurs within 6-8 weeks of its first appearance [17].

SURGICAL CLOSURE

If the fistula does not close spontaneously, surgical intervention is indicated in the appropriate surgical candidate. Timing of the surgery seems to be important in order to reduce the likelihood of refistulization [5,7,24]. A case series by Lynch et al. showed a risk of fistula recurrence of 20.7% at three months and of 17% at 12 months [24]. Those who had surgery prior to 3 months had a refistulization rate of 28% [24]. Authors of case series recommend waiting between 3 and 6 months to repair the fistula [5,24]. This time allows resolution of dense peritoneal adhesions, for the abdomen to become "soft" and for the patient to be sepsis-free [13,17,24,25].

Table 2
Factors Affecting Likelihood of Closure

Factor	*Likely to Close*	*Unlikely to Close*
Anatomic Location	Esophageal Duodenal Stump Pancreatobiliary	Gastric Small bowel
Sepsis	Absent	Present
Etiology	Appendicitis Diverticulitis Postoperative	IBD Cancer Radiation Foreign body (mesh, staple, or stent)
Condition of bowel	Healthy adjacent tissue Small leak No abscess Quiescent disease	Total disruption Distal disruption Abscess Active disease
Other	Tract >2 cm in length Low output	Tract <2 cm, epithelialized High output

Adapted from: Maykel J, Fischer J. (2)

DIAGNOSTIC TESTS

Diagnostic tests are used to determine whether abscesses are associated with the fistula as well as to define the anatomy of the fistula and surrounding bowel. Identifying the presence of abscesses is crucial to controlling sepsis [17]. Using radiologic testing is necessary because the classic signs of infection (fever and leukocytosis) may be absent in patients with a "walled off" abscess [17,26]. CT is currently the preferred test for identifying abscesses in the abdomen [27]. The clinician can also gain some knowledge of the origin of the fistula based on the quality and quantity of the fistula output. Occasionally, blue dye will be given by mouth or via a feeding tube to determine whether the output is from a gastrointestinal source. However, to more precisely identify the site of origin, to measure healthy bowel and check for obstructions above and distal to the fistula, radiologic studies are necessary [27]. Contrast-enhanced fluoroscopic studies including fistulograms, small bowel follow through, enteroclysis, and/or using a contrast agent enema exam are all helpful in diagnosing intestinal fistulas [27]. A fistulogram involves externally instilling water-soluble contrast into the fistula via a catheter and then periodically evaluating the movement of the dye with fluoroscopy and spot radiographs [27].

ABSCESSES

Assessment of the variables that will impact the EC fistula treatment plan begins with identifying the anatomy of the fistula and bowel. Subsequently it includes quantifying the volume of output and the ability to protect the skin or tissue surrounding the fistula [16,17]. Since sepsis is the main cause of mortality in fistula patients, if there are abscesses associated with the fistula, they must be drained or a diverting stoma must be created prior to starting EN due to the concern that the abscess may be in communication with the bowel [17,23]. Typically abscesses are drained with a percutaneous drain and antibiotics are administered [17]. Once abscesses that are in communication with the bowel have been eliminated or a diversion has been created, EN can be initiated, assuming other variables have been considered. For example, if there is an obstruction distal to the fistula, no attempts will be made to enterally feed the patient distal to the fistula.

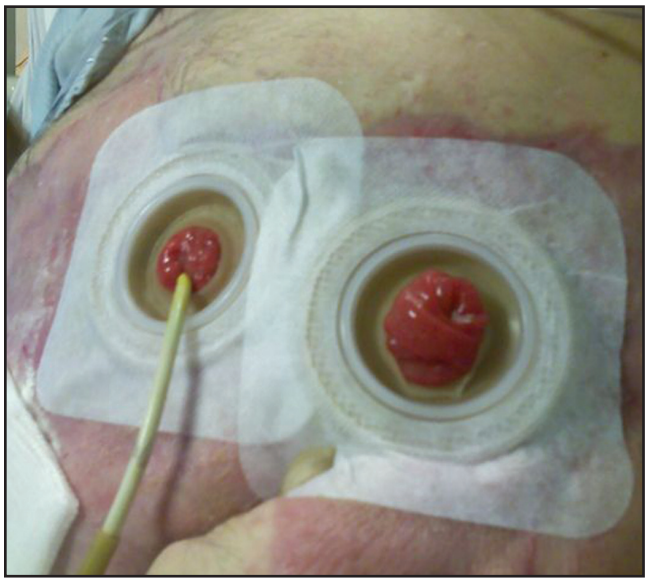

Figure 1.

NUTRITION PLAN

Knowledge of the origin of the fistula is critical to those who are open to the possibility of feeding via the gastrointestinal tract (GI). If the fistula is in a proximal location, there is the possibility of placing a feeding tube distal to the fistula [5] using a percutaneous gastrostomy with a jejunostomy arm (PEG/J) or using a nasojejunal tube. If the fistula is very distal, such as distal ileal or colonic, the patient can potentially obtain full nutrition by mouth or via gastric tube [5]. However, if the fistula is located in the small bowel too distal for a PEG/J to pass, yet not distal enough to allow adequate enteral absorption proximal to the fistula, then the possibility of fistuloclysis can be addressed [14]. Fistuloclysis involves placing a feeding tube under radiology directly into the fistula. Teubner et al. described a case series of EC fistula patients who were successfully fed in this manner [14]. A few other case studies have also been reported [28,29]. In order for this method to be successful, there must be enough unobstructed bowel distal to the fistula in continuity for adequate nutrient absorption. In Teubner et al.'s case series that length was 75 cm [14]. The patients also had to be without infection, hemodynamically stable and the likelihood of spontaneous closure was very unlikely as the fistulas were epithelialized [14].

The choice of EN formula seems to be important in the success of fistuloclysis. At Teubner's center, the protocol is to start with a polymeric formula [14]. If the patient complains of abdominal pain that lasts >24 hours after EN is initiated, or the patient has persistent diarrhea, the formula is changed to a semi-elemental product [14]. Similarly, if the patient does not tolerate the semi-elemental formula, they are switched to an elemental formula [14]. In Levy's case series, successful fistuloclysis feeding was achieved using an elemental formula [12].

In terms of oral diet modification, a recommendation is highlighted by both the case series by Teubner et al. [14] and by Datta et al. [7]. The intake of low sodium beverages needs to be limited to <500 ml/day. Instead consumption of 1 L/day of an electrolyte (oral rehydration) solution is advised.

The volume of output can influence the decision of whether or not to enterally feed for two main reasons. Some clinicians believe that if the output is high (>500 ml/day), an enteral or oral diet should not be allowed and only PN used [5]. In fact, if the volume is such that it cannot be managed, that is, if the surrounding tissue cannot be protected from the fistula effluent and withholding EN and oral feeding significantly reduces the output, then enteral/oral feedings may need to be held. Second, the volume of output influences the feeding decision based on net fistula losses. As the volume of output increases, loss of electrolytes, proteins, bile salts, pancreatic enzymes and fluid can increase such that the patient's nutritional status cannot be maintained without PN.

PHARMACOLOGICAL PLAN

For high output fistulas, Teubner et al. [14] and Datta et al. [7] reported pharmacologic efforts to minimize the fistula effluent that included histamine-2 receptor antagonists (H_2RAs) or proton pump inhibitors (PPI) to reduce gastric secretion volume and acidity [17, 30], and loperamide and codeine to reduce fistula output.

PPIs are more effective than H_2RAs at reducing the volume and acid content of stomach secretions [31]. They block more acid producing receptors than H_2RAs and they cause prolonged inhibition of H^+-K^+-ATPase [31]. This results in less acid release into the stomach.

Loperamide (Imodium, Kaopectate II, Pepto Diarrhea Control) is sold over the counter due to its excellent safety profile. Adverse drug reactions (ADR) are very rare and include rash and paralytic ileus [32]. Datta et al. report using up to 36 mg/day of loperamide, as well as up to 240 mg codeine phosphate/day [7].

Diphenoxylate (Lomotil, Lonox, Logen, Lomanate) activates opioid receptors in the GI tract thereby reducing intestinal motility [31]. It also reduces small intestine secretions and increases fluid and electrolyte absorption [31]. If taken in correct doses, it does not affect the central nervous system. To reduce the chance of abuse and to further reduce GI secretions, atropine is added. As an anticholinergic, the ADR of atropine include: nausea, dizziness, photophobia, increased heart rate, loss of balance, and confusion [31].

Octreotide is an analog of somatostatin that reduces secretions from the GI tract, the liver, and the pancreas [33]. It also reduces motility of the GI tract [33] and also reduces secretions of many hormones—gastrin, insulin, glucagon, cholecystokinin, growth hormone and others. Somatostatin is not available in the United States.

Of the medications discussed above, only octreotide has been studied in randomized fashion in EC fistula patients [34–36]. Sancho et al. used 100 mcg of octreotide every 8 hours in 14 postoperative EC fistula (stomach or small bowel) patients and placebo in 17 patients [34]. They found no difference in fistula closure between the groups [34]. Nubiola et al. gave octreotide for 2 days and then placebo for 2 days to patients with postoperative small bowel fistulas [35]. The dose was 225–300 mcg/day given every 8 hours. Fistula output was reduced in all patients while they received octreotide. The reduction was from a mean of 828 mL/day to 247 mL/day [35]. Scott et al. studied patients with postoperative EC fistulas [36]. Their intervention group received 100 mcg octreotide 3 times a day. There was no difference in fistula output between the groups at the end of 12 days [36]. Thus there is not strong support for the use of octreotide. Some authors recommend a 5–8 day trial of 100–300 mcg every 8 hours (38) and if there is no significant reduction in fistula output within 5–8 days, then discontinuing the octreotide [13]. The ADR for octreotide include: abdominal pain, nausea, vomiting, constipation, steatorrhea, diarrhea and bradycardia [33].

TREATMENT GUIDELINES

Currently there are no treatment guidelines for patients with EC fistulas other than guidelines created by individual institutions. This may be due to the fact that the body of evidence in this area is limited to case series, case reports, review articles and small trials investigating the effects of octreotide. The relative lack of robust evidence is probably due to the complexity of EC fistulas and the relatively low incidence of patients with EC fistulas at most institutions.

Despite the knowledge that EN is preferable to PN, many physicians choose to not feed the gut and to instead deliver PN for all patients with EC fistulas. This decision may be due to the belief that EN will prevent closure of the fistula, due to the complexity of managing an enterally fed EC fistula patient and/or due to the lack of well-established clinical guidelines for the management of these patients. Regardless of the reason for the decision to avoid feeding via the GI tract, there is a need to increase awareness of the potential to enterally feed these patients. To accomplish this, as well as for patients who must be parenterally fed, there is a need for studies evaluating the use of medications that can reduce fistula losses. These medications include: H_2RAs, PPIs, gut-slowing agents alone or in combination with octreotide. There is also the potential to increase the practice of reinfusion of fistula effluent via a more distal fistula. It is worth noting that there are case series and case studies that report success utilizing this technique [12,28]. When this technique is successful, PN can be avoided.

PHARMACOLOGICAL INTERVENTION IN THE CASE STUDY

To minimize fistula output several medications were tried in our case study patient in different combinations, dosages, and forms. Due to its local effects on the GI tract, loperamide was delivered by mouth to reduce fistula output and in liquid form via the feeding tube to reduce diarrhea, when needed. The dose was adjusted accordingly based on response. Our patient received 10 ml Lomotil b.i.d. to q.i.d. based on fistula output. A PPI was administered initially in IV form and then as the orally disintegrating, delayed release form, a form that is absorbed in the proximal small

Table 3
Effluent pH levels of fistula output

Date	*Effluent pH*
9/15	6.9
10/16	6.7
11/4	5.6
11/5	6.8

intestine. This patient's fistula effluent pH levels were monitored to ensure effectiveness of this medication (goal pH level was >5.5) after it was changed from the IV to the oral form and periodically to ensure its continued effectiveness (see Table 3). A 7-day trial of octreotide did not result in clinically significant reduction in fistula output in our patient, therefore it was discontinued.

NUTRITIONAL INTERVENTION IN THE CASE STUDY

The management of this patient's nutrition regimen required close monitoring and frequent adjustments based on his tolerance to the regimen and laboratory values and overall clinical progress. The electrolyte content of the supplemental IV fluids and the PN were adjusted almost every week due to his fluctuating fistula losses.

The nutritional goal for this patient was to improve and then maintain his nutritional status to allow for the best surgical outcome after fistula repair. In addition, the goal was to do so in the most economical and least time-consuming way. This was done using both the parenteral and enteral routes and by using medications to minimize fistula losses.

Table 4
Weight history

Date	*Wt (lb)*
2001	253
7/3/08	244
8/11/08	214
11/2/08	171
1/9/09	165
3/15/09	180
4/3/09	182

Height = 6′0″
Ideal body weight = 180#

Early in his clinical course, feeding via the GI tract was attempted using a nasogastric feeding tube. Soon after this attempt, it was determined that there was inadequate bowel proximal to this fistula for adequate nutrient absorption. Enteral feedings were held until access was achieved via the mid-jejunal (distal) fistula. When enteral feedings were not sufficient, PN was used.

A polymeric EN formula was used initially in our patient. The patient complained of abdominal pain, so the formula was changed to a semi-elemental product that was well tolerated. Teubner et al.'s case series demonstrated that a minority of patients tolerate a polymeric formula [14]. No other case series or studies in EC fistula patients compare different types of formulas. Nor are there studies that report the use of pancreatic enzymes to avoid the need for semi-elemental or elemental formulas in these patients.

Reinfusion of fistula output was carried out for several weeks. However, due to the extra work this required on top of a very demanding home care schedule, the patient and his wife opted to discontinue the reinfusion. Most cases of EC fistula patients who are having their output reinfused are in the hospital [12]. However, there is one case study of a home patient who successfully reinfused output into a distal tube [28]. Some case studies/series report successful fistuloclysis without reinfusing output [14,29]. There may be a certain output volume at which fluid, bicarbonate, bile salts and electrolytes losses are high enough that reinfusion is more clinically beneficial. The patient is currently off nutrition support and doing well at home. See Table 4 for this patient's weight history.

SUMMARY

Management of patients with EC fistulas can be very challenging. This management requires the collaboration of experts from multiple disciplines including surgeons, gastroenterologists, nutrition support dietitians,

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wound continence ostomy nurses, and interventional radiologists. The treatment plan depends on multiple variables and must be customized for each patient. Currently there are no well-established, evidence-based clinical guidelines for managing the medications and nutrition care of these patients. Future research investigating the effectiveness of various nutritional and pharmacologic aspects of the treatment plan could help with the development of better clinical guidelines. The end result would be decreased morbidity and mortality, and potentially, reduced financial burden to the healthcare system. ■

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