REVIEW ARTICLE

Interventional Radiologic Management and Treatment of Enterocutaneous Fistulae

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ABSTRACT

Enterocutaneous fistulae (ECFs) are abnormal sinus tract communications between the alimentary system and skin surface that can cause significant management problems and cost to the health care system. Interventional radiology can play an important role in diagnosis and treatment when conventional measures fail and additional surgery is difficult or poses a high risk. The management of patients with fistulae requires operator ingenuity and dedication, a multidisciplinary team approach, and an understanding of the pathophysiology. This article reviews the major issues in ECF management and the role of interventional radiology.

ABBREVIATIONS

AFP = anal fistula plug, ECF = enterocutaneous fistula, ECM = extracellular matrix, IBD = inflammatory bowel disease, TPN = total parenteral nutrition, WV = wound vacuum

Enterocutaneous fistulae (ECFs) are feared sequelae of many medical conditions such as abdominal surgery, inflammatory bowel disease (IBD), and abscesses (1,2). ECFs can lead to malnutrition, sepsis, and even death. Even low-morbidity fistulae can impair quality of life and cause psychologic issues (3).

The surgical definition of a fistula is an abnormal connection between two epithelialized surfaces. Fistulae are named by the direction of flow. For example, in gastrocutaneous fistulae, gastric contents drain to the skin surface directly through an abnormal tract. This review will focus on the management and treatment of ECFs between the stomach, small intestine, or colon and the skin surface (excluding etiologically disparate perirectal fistulae).

Management of ECFs requires a multidisciplinary team communication between numerous health care providers including surgeons, gastroenterologists, radiologists, nutritionists, wound care specialists, enterostomal therapists, and psychiatrists/psychotherapists. This article reviews the diagnosis and treatment of ECF and the role of interventional radiology with minimally invasive treatment methods. There is limited literature regarding percutaneous ECF closure methods, which allows ample opportunity and need for expanded research in this area.

BACKGROUND

The mortality rate from ECFs is reported between 10% and 30% (4,5). ECFs allow enteric contents to contaminate sterile spaces and may cause infection and sepsis. Decreased flow through the distal digestive tract in high-output fistulae can produce local inflammation, fluid depletion, electrolyte imbalance, and malnutrition, leading to catabolic conditions (6). This prevents healing of skin inflammation and necrosis caused by excess succus and bowel contents. Patients with ECFs have longer hospital stays, increased financial hardship, and decreased quality-of-life measures (7,8). The chronicity of ECF can lead to mental distress with resulting decreased self-esteem and depression (3).

Although ECFs have many causes, the majority (as many as 85%) are iatrogenic/postoperative (9). This includes fistulae caused by unintended enterotomy and failure of surgical bowel anastomoses. Iatrogenic ECF has been reported following embolization for gastrointestinal bleeding, with ischemic bowel perforation, abscess, and fistula development (10). Fistulae have also been reported with palliative enteric stents (11) and traumatic penetrating bowel injuries (12). De novo

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ECFs may result from underlying IBD or ulcerating tumors.

Prognostic Factors

A useful interventional radiologic management algorithm is best developed by understanding ECF etiology and wound healing. Fistula location and anatomy can greatly affect prognosis and treatment as a result of widely variable physiologic function and location of bowel, underlying disease processes, and surgical interventions. These factors make fistula mapping a critical first step. Esophageal fistulae appear to have shorter spontaneous closure times without intervention than other types of ECFs (13). Gastric fistulae are less likely to close spontaneously secondary to acidic skin and tissue injury. High-flow ECFs involving the small bowel, particularly the duodenum (14) and ileum, are unlikely to close spontaneously and pose a higher risk of causing malnutrition. These may require more aggressive treatment attempts. Long, narrow fistulae heal more spontaneously than short fistulae of larger caliber (15). Fistulae with abdominal wall disruption as a result of complex open wounds or dehiscence are difficult to treat and require coordinated care with ostomy specialists. ECFs with established skin openings are relatively easier to treat.

It is equally important to quantify the flow of digestive contents through ECFs. High-output fistulae drain greater than 500 mL over a period of 24 hours. These usually arise from small bowel, where large volumes of digestive material pass quickly. High-output fistulae cause significant nutritional morbidity from diversion of enteric contents and often require total parenteral nutrition (TPN) (16). Medium-output fistulae drain between 200 and 500 mL over a period of 24 hours, and low-output fistulae drain less than 200 mL over a period of 24 hours. These usually arise from large bowel. Patients with low-output fistulae often do well with oral nutrition alone. Color and odor of the drainage can foretell the small-bowel or large-bowel origin of the ECF.

A number of additional factors contribute to ECF formation and affect closure rates. A useful mnemonic describing these is "FRIENDS": Foreign bodies, Radiation treatment, Inflammatory bowel disease (Crohn disease and ulcerative colitis) and ischemia, Epithelialization (more commonly tissue granulation/fibrosis), Neoplasms, Distal obstruction, and Sepsis.

Foreign bodies hinder healing and prevent spontaneous closure by causing inflammation and serving as a nidus for infection. Retained hernia mesh and suture material are often implicated, and the ECF may not heal without removal (17).

Integrity of the bowel and surrounding tissue is important for closure of ECFs. Radiation can cause enteritis and damage of vasa recta. Ischemia and inflammation from radiation and other causes lead to mucosal inflammation, perforation, abscesses, and fistulae. IBD, most commonly Crohn disease, is another cause of gastrointestinal inflammation, ulceration, granulation, and fistula development. These ECFs may remain unhealed in active disease. Maturation of chronic fistulous tracts with granulation tissue prevents spontaneous closure. True epithelialization with metaplastic glandular or squamous tissue is rare except in perirectal fistulae because of the difference in mechanism. Most chronic tracts contain granulation or fibrous tissue. Metaplasia has also been implicated in the rare development of fistula-associated adenocarcinoma (18). A neoplasm at the fistulous origin will interrupt the normal mucosal surface and cause inflammation and tissue destruction that can lead to ECFs and prevent closure. Distal obstruction can impair closure by causing increased fistula output and pressure, and should be suspected in recurrence of a previously healed fistula. Sepsis prevents ECF closure by causing catabolism and decreased healing, and is discussed here later.

Approach to Management

A mnemonic useful in approaching the management and treatment of ECF is the word "SNAP": Sepsis control, Nutritional support, Anatomy definition, and Plan.

Sepsis control is one of the most important determinants in ECF outcome (19). The catabolic state of sepsis decreases nutrition and immune response, significantly decreasing closure rates. Sepsis also limits many surgical and interventional radiologic closure procedures. Interventional radiologic drainage of fluid collections and abscesses is important to allow optimum healing, prevent sepsis, and reduce the risk of ECF formation.

Nutritional status is extremely important for successful fistula closure. Similar to sepsis, malnutrition leads to a catabolic state and reduces healing (20,21). The role of correcting nutritional status with TPN is controversial. TPN has been shown to decrease fistula output, but not reduce closure times or improve mortality, and is associated with numerous risks (22). Enteric feeding promotes the immunologic, hormonal, and barrier functions of the gut and newer elemental formulations can reduce fistula output comparable to TPN (23). Fistuloclysis, the practice of inserting a tube through the fistula into the distal bowel for feeding, has been shown to be a viable nutritional substitute for TPN (24). This is more useful in proximal fistulae with increased digestive surface area distally but may prevent ECF closure from tract maturation.

Anatomic mapping of the fistula source and characteristics yields prognostic information and helps plan an approach to treatment. Imaging performed to evaluate anatomy can also reveal the cause of the fistula (ie, anastomotic breakdown, neoplasm, or active IBD) and further guide management.

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