

The Etiology of Enterocutaneous Fistula Predicts Outcome

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ABSTRACT

Background: The management of enterocutaneous fistula (ECF) provides a supreme challenge for the general surgeon.

Methods: We conducted a retrospective review of all cases of patients with ECF referred to the surgical service from July 2007 to June 2011 to achieve a better understanding of the factors that predict a successful outcome.

Results: A total of 35 patients were evaluated and managed in a systematic fashion that focused on treatment of abdominal sepsis, control of fistula output and wound management, nutritional optimization, and operative intervention when necessary. Age, gender, preoperative laboratory values, etiology of ECF, and prior abdominal surgery for ECF were reviewed and compared. Fisher exact test was used to compare patients who achieved a good outcome (n=23) to those with a poor outcome (n=12) to determine factors that might predict their ultimate result. Two factors that predicted poor outcome were the presence of abdominal malignancy (P=0.01) and ECFs that occurred in trauma patients with an open abdomen (P=0.03).

Conclusion: The etiology of ECF proved to be a more reliable predictor of outcome than clinical indicators.

INTRODUCTION

The management of enterocutaneous fistula (ECF) provides a supreme challenge for the general surgeon. The development of intestinal drainage is never expected and is associated with infectious complications, skin breakdown, nutritional compromise, and potential death. Aside from patients with inflammatory bowel disease, a malignancy that erodes the bowel wall, or direct trauma to the bowel in an open abdomen, nearly all ECFs are the result of surgical misadventure during abdominal surgery.^{1,2} Once an ECF occurs, the initial management requires elimination of any factor that would prevent spontaneous closure and promote ongoing intestinal drainage to the skin. These factors are easily remembered through the use of the mnemonic FRIEND that stands for foreign body, radiation, inflammatory bowel disease, epithelialization, neoplasia, and distal obstruction.³ Simultaneously with the elimination of the FRIEND factors, the surgeon must focus the patient's management on resuscitation, elimination of undrained abdominal infection, control of intestinal output and skin protection, nutritional optimization, and eventual surgical correction if nonoperative management fails to achieve spontaneous closure within a reasonable period of time.

Numerous authors have summarized these principles of ECF management over the past decades, but no one has contributed more to this field than Josef Fischer. Dr Fischer's thoughtful approach to ECF patient management is succinctly summarized in a recent review.⁴ Strict adherence to Dr Fischer's principles of management can result in excellent patient outcomes; however, failure to restore intestinal integrity and the patient's subsequent death are part of the reality for surgeons who manage these challenging patients. Large recently reported case series demonstrate a spontaneous closure rate of 20%-37%, an 82%-91% success rate, and 8%-13% mortality for patients with ECF managed in tertiary referral hospitals.⁵⁻⁸ These results demonstrate the

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challenges associated with the management of these patients.

METHODS

We reviewed our recent experience with ECF management to better understand the factors that predict successful outcomes in patients with ECF. We reviewed the records of all patients with ECF referred to our surgical service from July 2007 to June 2011. The surgical service at Atlanta Medical Center provides comprehensive care to a patient population in an inner-city hospital. Subspecialty surgical services are not typical at this hospital. A total of 35 patients were identified. Patients were evaluated and managed in a systematic fashion that focused on treatment of abdominal sepsis, control of ECF output, wound management, nutritional optimization, and operative intervention when necessary. Once a patient with ECF was admitted to the surgical service and adequately resuscitated, a routine algorithm was employed to manage the condition.

First, a computed tomography (CT) scan of the abdomen and pelvis was performed to rule out the presence of undrained intestinal contents. Intestinal contents noted by CT were drained by percutaneous techniques.^{9,10} The liberal use of follow-up CT imaging was necessary to ensure complete drainage.

Once abdominal sepsis was controlled, enterostomal therapists and wound care nurses were enlisted to help develop strategies to control ECF output and protect the surrounding skin.¹¹⁻¹³ Closed vacuum systems were often used to manage the fistula output.^{14,15} Nonadherent dressings between the viscera and sponge helped minimize the possibility of creating new ECFs during dressing changes. Administering octreotide^{16,17} and limiting oral intake helped reduce the volume of ECF output.

After control of abdominal sepsis and wound management were achieved, the next priority in patient management was nutritional optimization. While total parenteral nutrition was always required, a transition to enteral nutrition was important for maintaining gut integrity. Maintaining gut integrity was considered vital to maximize the success for the intestinal anastomosis that might be required for definitive surgical management of ECF.^{18,19} Feeding tubes were placed via the nose or endoscopically in the stomach when patients had a functioning gastrointestinal tract but lacked the ability or desire to ingest calories.

Once controllable factors that prevent ECF resolution had been addressed and the abdominal sepsis, wound control, and nutritional status had been optimized, the likelihood of spontaneous resolution was assessed. In general, if ECF output

reduction had not been dramatically achieved within 1 month of presentation and the preceding management priorities had been addressed, patients were scheduled for corrective surgery. The only situation that argued for a delay in operation beyond 4 to 6 weeks after presentation was a patient with a particularly hostile abdomen at the sentinel operation that resulted in the ECF. A particularly hostile abdomen argues for additional delay before considering reoperation. A review of all prior operative records and direct communication with prior operating surgeons were considered essential to adequately prepare for a reoperation.

At operation, a complete assessment of the gastrointestinal tract with lysis of adhesions from stomach to rectum was performed to ensure that any distal obstruction was eliminated. Once the site of ECF origin was identified and distal obstruction eliminated, the source was resected, and a hand-sewn, single-layer silk suture bowel anastomosis was performed. The authors prefer the resection and hand-sewn anastomosis technique to suture repair of the ECF or stapled anastomotic techniques because evidence suggests superior outcomes.²⁰

A decompressive gastrostomy was routinely employed and was transitioned to a feeding tube if necessary. Because the primary goal of this operation was to achieve intestinal continuity and allow the patient to regain the ability to eat and independently achieve positive nitrogen balance, complex closure of the abdominal wall was deferred until a later time.

Age, gender, preoperative laboratory values, etiology, and location of the ECF were reviewed and compared. Serum albumin was chosen as a marker of nutritional status in the weeks preceding surgical intervention. Creatinine was chosen as a gauge of renal function. Ongoing inflammation level and acute nutritional status were evaluated by the white blood cell count. Bone marrow function was evaluated with platelet count. Prior abdominal surgery for ECF, an ECF associated with a malignancy, and an ECF resulting from trauma were also compared between the outcome groups.

A successful outcome was defined as patients regaining the ability to eat normally, maintaining a positive nitrogen balance without supplementation based on serum albumin and total protein levels, and functioning independently at home after hospital discharge. A poor outcome was defined as anything less. Patients who achieved a good outcome were compared to those with a poor outcome to determine factors that might predict their ultimate result. Fisher exact test was used for statistical analysis, with a *P* value of less than 0.05 defining significance.

Table. Parameters Evaluated to Predict Outcomes in Patients With Enterocutaneous Fistula

Parameter	Good-Outcome Group (n=23)	Poor-Outcome Group (n=12)	P Value
Age, years	53	49	NS
Male:Female Ratio	9:14	4:8	NS
Preoperative Laboratory Values (mean / range)			
Albumin, g/dL	2.9 (1.7-4.0)	2.5 (1.7-3.5)	NS
Creatinine, mg/dL	1.1 (0.3-10.1)	0.7 (0.3-1.3)	NS
White Blood Cell Count, 1,000/ μ L	7.3 (3.4-14.5)	8.5 (3.8-22.2)	NS
Platelet Count, 1,000/ μ L	299K (131-538)	283K (87-458)	NS
Prior Attempt at Corrective Surgery	4	5	NS
Site of Fistula			
G/D/SB/C/R	1/2/15/3/2	1/0/11/0/0	NS
Trauma	0	3	0.03
Abdominal Malignancy	0	4	0.01

G/D/SB/C/R, gastric/duodenal/small bowel/colon/rectal; NS, not significant.

RESULTS

A good outcome was achieved in 23 patients, while 12 had a poor outcome. Ten of the 12 poor-outcome patients ultimately died. Preoperative laboratory values did not demonstrate a statistically significant difference between the outcome groups in comparisons of albumin, creatinine, white blood cell count, or platelet count. Prior abdominal surgery with attempted ECF takedown and closure was not a statistically significant predictor of a poor outcome. Two factors that did predict a poor outcome were the presence of abdominal malignancy ($P=0.01$) and fistulas that occurred in trauma patients with an open abdomen ($P=0.03$).

Parameters evaluated to predict the outcomes in the 2 groups are shown in the Table. Four patients in the good-outcome group had undergone previous abdominal surgery for attempted ECF takedown; all 4 had successful ECF takedown after nutritional optimization. None of the patients in the good-outcome group had an ECF etiology related to trauma or active malignancy. Two patients had active Crohn disease at the time of the initial abdominal surgery and subsequently developed an ECF, while ECF in 1 patient was the result of radiation for the treatment of cervical cancer. The fistulas of 2 patients spontaneously resolved with conservative management. One was a small-bowel ECF following an appendectomy for a necrotic appendix; the other was a colonic fistula in a patient who underwent a subtotal gastrectomy for a gastric malignancy.

Of the 10 patients who ultimately died from complications of their ECFs, 5 had undergone previous unsuccessful abdominal surgery aimed at ECF takedown prior to referral. Four of these patients underwent another unsuccessful attempted ECF

takedown by our group after nutritional optimization. The fifth patient with uterine carcinoma and peritoneal disease treated with radiation therapy never achieved positive nitrogen balance on our service and opted for hospice care instead of an attempt at surgery. One patient in the poor-outcome group suffered from chronic lymphocytic leukemia and colonic adenocarcinoma, developed an ECF after radiation therapy, and was never able to achieve an adequate preoperative nutritional condition. She was referred for hospice care. Two additional patients with ECF as a result of malignancy underwent an operation at our institution, had a poor outcome, and ultimately died of their disease with persistent ECFs. Three patients in the poor-outcome group had ECFs resulting from traumatic injury treated with damage control surgery and an open abdomen. Two of these 3 patients underwent multiple unsuccessful operations for ECF takedown prior to referral to our surgical service. All 3 had surgery at our hospital where the ECF was resected, an intestinal anastomosis was created, and abdominal wall reconstruction with absorbable mesh was performed. ECF location varied among the trauma-related ECF group: 1 ECF was located in the proximal jejunum, 1 was located in the mid-ileum, and 1 was located at the terminal ileum. All 3 of the trauma-related ECF patients ultimately developed sepsis with multisystem organ failure leading to death. None of the poor-outcome patients suffered from Crohn disease nor were any able to achieve resolution of the ECF with conservative management. Only 2 of the patients in the poor-outcome group are currently alive. One left our institution after a failed ECF operation and had another unsuccessful surgery followed by a successful procedure at another institution. One poor-outcome patient is alive and

homebound with a persistent ECF that is managed with excellent wound care. The patient has refused consideration of another corrective procedure.

DISCUSSION

The goal in managing patients with ECF is to restore intestinal continuity with the intention of reestablishing independence and tolerance of an oral diet. This goal was achieved in 65.7% of patients in this review. The failure rate for this series is inferior to the rates reported by other investigators; however, we believe that the results reflect the management of a particularly challenging group of patients, reflected in the 5.7% rate of spontaneous ECF closure in this series. This rate is dramatically less than other reports and reflects a referral pattern that results in receiving patients for whom conservative management was unsuccessful prior to patient transfer.⁵⁻⁸ When the 2 most challenging subgroups of patients are excluded (trauma and malignancy), we achieved an 82.1% good result for patients with ECF, which is comparable with other series. The uniformly poor outcome for advanced malignancy and trauma patients in our study argues for a reevaluation of the management approach in these especially challenging patients.

Patients with advanced malignancy are difficult to optimize nutritionally given the starvation state that may be present.²¹ Both patients in the poor-outcome group who suffered from advanced abdominal malignancies could never be nutritionally optimized for surgical resection of the ECF. Cancer is a recognized etiology of fistula, but the underlying disease process can preclude successful treatment of ECF either by resolution or surgical resection. Unless the primary malignant process can be completely resected, attempted surgical resection is unlikely to result in cure of the ECF. Despite the poor outcomes in such patients, the principles of palliative surgical care lead to referral of these patients because their ECF is often the primary symptom impacting their quality of life.^{22,23} Strong consideration for the use of palliative octreotide to reduce gastrointestinal secretions and a decompressive gastrostomy tube to avoid nausea and vomiting might be a preferred option.²²⁻²⁴

The 3 patients with an ECF after blunt abdominal trauma with gastrointestinal contamination had a loss of abdominal domain when their abdomens were left open. Exposed bowel without overlying protective soft tissues is vulnerable to an enterotomy or desiccation with epithelialization of a fistula tract.²⁵ This unique entity of ECF, termed by some as an enteroatmospheric fistula, has been recognized as resistant to conservative management techniques that are successful in other ECFs. The loss of native tissue barriers is compounded by the chronic inflammatory state characterized by elevated

C-reactive protein levels. Therefore, despite nutritional supplementation with total parenteral nutrition, these patients continued to preferentially manufacture acute-phase reactants rather than stores of albumin. Without nutritional stores dedicated to healing after ECF resection, all 3 patients had a recurrence of their ECF that ultimately contributed to their demise. Ramsay and Mejia report using catheters to drain an enteroatmospheric fistula through the lateral intact abdominal wall.²⁶ By redirecting the enteric contents away from the open abdomen, success can be achieved. This technique may be a potentially attractive alternative to the approach used in this series.

CONCLUSION

A systematic approach to the treatment of ECF is critical. Even with adherence to the algorithm of intraabdominal sepsis control, wound management, and nutritional optimization, poor outcomes cannot be avoided. Our retrospective review showed that clinical indicators failed to predict the likelihood of successful treatment. Instead, the etiology of ECF proved to be a more reliable predictor of outcome. Our results show that an alternate approach to managing ECF in trauma patients and in patients with uncontrolled abdominal malignancy is warranted. Catheter drainage through the lateral intact abdominal wall in enteroatmospheric fistulas and a minimalist approach in patients with advanced malignancy may be more appropriate than a major complex reoperation. Thoughtful analysis of outcomes is critical to achieving performance improvement in the future. While prevention is the best treatment for ECF, a thoughtful and committed approach to patient management will help ensure the best possible outcome.

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