Management of Enterocutaneous Fistulas Worldwide: Challenges, Practices, and Outcomes

Dünya Çapında Enterokutan Fistüllerin Yönetimi: Zorluklar, Uygulamalar ve Sonuçlar

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ABSTRACT

Enterocutaneous fistulas (ECFs) are among the most devastating complications in surgical practice. Management requires a multidisciplinary approach focused on sepsis control, nutritional optimization, fistula closure, and restoration of quality of life. A comprehensive review of PubMed and Google Scholar was conducted for the period from 2000 to 2025. Given the paucity of recent literature from low- and middle-income countries (LMICs), data from the past 25 years were included to capture broader insights into the topic. The Salford unit in the United Kingdom introduced the SNAP strategy (Sepsis, Nutrition, Anatomy, and Plan), which emphasizes infection control, nutritional support, anatomical definition, and surgical planning. While this structured approach has improved outcomes in high-income countries (HICs), its translation to LMICs remains challenging. Limited access to broad-spectrum antibiotics, advanced imaging, and modern wound care techniques hampers early management. Nutrition, which is central to fistula therapy, is optimized in HICs through tailored enteral and parenteral regimens. In contrast, LMICs often depend on modified oral or nasogastric feeding, which, although less effective, can provide reasonable outcomes when delivered consistently. Definitive management includes effluent control, skin protection, and surgical intervention. Advanced modalities such as negative pressure wound therapy (NPWT), octreotide, parenteral nutrition, and abdominal wall reconstruction with biological meshes are widely available in HICs. In LMICs, however, clinicians frequently rely on improvised NPWT systems, have limited access to pharmacological adjuncts and parenteral nutrition, and often resort to staged operations with fewer reconstructive options. This review highlights persistent management gaps in LMICs and emphasizes the urgent need for more robust data to better define challenges, guide policy, and adapt treatment strategies to resource-limited settings.

Keywords: Developing countries, enterocutaneous fistula, intestinal fistula, negative-pressure wound therapy, nutrition therapy, sepsis

ÖZ

Enterokütanöz fistüller (EKF), cerrahi pratiğin en yıkıcı komplikasyonları arasında yer almaktadır. Yönetim; sepsis kontrolü, beslenmenin optimizasyonu, fistülün kapatılması ve yaşam kalitesinin yeniden sağlanmasına odaklanan multidisipliner bir yaklaşım gerektirir. 2000–2025 dönemini kapsayan kapsamlı bir PubMed ve Google Scholar taraması yapılmıştır. Düşük ve orta gelirli ülkelerden (LMIC) güncel literatürün sınırlı olması göz önünde bulundurularak, konuya daha geniş bir bakış açısı kazandırmak amacıyla son 25 yılın verileri dahil edilmiştir. Birleşik Krallık'taki Salford ünitesi, enfeksiyon kontrolü, beslenme desteği, anatomik tanımlama ve cerrahi planlamayı vurgulayan SNAP stratejisini (Sepsis, Nutrition, Anatomy, Plan) geliştirmiştir. Bu yapılandırılmış yaklaşım yüksek gelirli ülkelerde (HIC) sonuçları iyileştirmiş olsa da, LMIC'lere uyarlanması çeşitli güçlükler taşımaktadır.

Geniş spektrumlu antibiyotiklere, ileri görüntüleme yöntemlerine ve modern yara bakımına sınırlı erişim erken dönemde yönetimi zorlaştırmaktadır. Fistül tedavisinin merkezinde yer alan beslenme, HIC'lerde özelleştirilmiş enteral ve parenteral rejimlerle optimize edilmektedir. Buna karşın LMIC'lerde sıklıkla modifiye oral veya nazogastrik beslenmeye başvurulmakta olup, bu yöntemler daha az etkili olsa da düzenli uygulandığında makul sonuçlar sağlayabilmektedir. Kesin tedavi; fistül akıntısının kontrolünü, cilt korunmasını ve cerrahi girişimi kapsamaktadır. Negatif basınçlı yara tedavisi (NPWT), oktreotid, parenteral beslenme ve biyolojik greftlerle abdominal duvar rekonstrüksiyonu gibi ileri modaliteler HIC'lerde yaygın olarak uygulanmaktadır. Ancak LMIC'lerde klinisyenler çoğunlukla doğaçlama NPWT sistemlerine başvurmakta, farmakolojik adjuvanlara ve parenteral beslenmeye erişimleri sınırlı kalmakta ve rekonstrüktif seçeneklerin daha kısıtlı olduğu aşamalı operasyonlara yönelmektedir. Bu derleme, LMIC'lerde süregelen yönetim boşluklarını vurgulamakta ve zorlukların daha iyi tanımlanabilmesi, politikaların yönlendirilmesi ve tedavi stratejilerinin kaynak kısıtlı ortamlara uyarlanabilmesi için daha güçlü verilere duyulan acil ihtiyacın altını çizmektedir.

Anahtar Kelimeler: Beslenme tedavisi, enterokütanöz fistül, intestinal fistül, negatif basınçlı yara tedavisi, sepsis

INTRODUCTION

Enterocutaneous fistulas (ECFs) are among the most devastating and complex complications in surgical practice. They are abnormal communications between the intestinal lumen and the abdominal wall and may arise spontaneously or, more commonly, following abdominal surgery or trauma.[1-4] Spontaneous fistulas are often linked to malignancy, inflammatory bowel disease, diverticulitis, appendicitis, or radiotherapy, whereas iatrogenic causes, such as resections for neoplastic or inflammatory bowel pathology and adhesiolysis, account for nearly 90% of cases worldwide. [3,4]

Several factors contribute to poor prognosis, including severe underlying disease, multiple prior laparotomies, prior radiotherapy or chemotherapy, profound metabolic and electrolyte disturbances, and the fistula itself, which perpetuates nutritional and metabolic derangements.[5] Despite advances in modern care, mortality remains high, between 10 and 20% overall and 5 to 15% even in specialized centers.[6] The classic triad of sepsis, malnutrition, and electrolyte imbalance, as described by Haack et al., continues to drive early morbidity and mortality. [7]

Effective management of ECFs demands a multidisciplinary approach with the goals of sepsis control, nutritional optimization, fistula closure, and restoration of quality of life.[8] While enteral or parenteral nutritional support and advanced wound care strategies are central to therapy in high-income countries (HICs), they remain largely inaccessible in low and middle-income countries (LMICs). The lack of total parenteral nutrition (TPN), negative pressure wound therapy, and adjuncts such as fibrin glue often necessitates prolonged conservative care and delayed surgery, further worsening outcomes.[9,10] Surgical repair is usually reserved for non-closure after several weeks of optimization, with most centers advocating a delay of at least three months.[11]

This narrative review aims to provide a comprehensive global overview of ECF management, comparing challenges, practices, and outcomes between HICs and LMICs. Specifically, it seeks to identify and analyze disparities in sepsis control, nutritional support, anatomical assessment, and definitive surgical strategies between HICs and LMICs within the SNAP framework. It examines how resource limitations, including inadequate infrastructure, limited diagnostic capacity, absent specialized equipment, and insufficient trained personnel, create fundamental barriers to implementing evidence-based ECF management in LMICs. Additionally, it highlights the critical shortage of robust epidemiological data and clinical research from resource-limited settings, thereby perpetuating the evidence gap and limiting our understanding of optimal management approaches in these contexts.

METHODS

A comprehensive literature search was conducted using PubMed and Google Scholar databases, emphasizing publications from 2005 to 2025. Search terms included: ("enterocutaneous fistula" OR "enteric fistula" OR "intestinal fistula") AND ("management" OR "treatment" OR "outcomes" OR "complications" OR "nutrition" OR "sepsis" OR "surgery"). Additional searches combined these terms with ("developing countries" OR "low income countries" OR "middle income countries" OR "resource-limited settings" OR "global surgery") to specifically identify LMIC literature. Google Scholar was included to capture gray literature and regional publications from LMICs underrepresented in traditional biomedical databases. No language restrictions were applied; non-English publications (Spanish, Bulgarian) with available abstracts were included when relevant.

Studies were included if they reported on ECF management strategies, outcomes (mortality, closure rates, complications), nutritional interventions, sepsis control, surgical techniques, or classification systems. Evidence types included retrospective and prospective studies, randomized trials, systematic reviews, clinical guidelines,

case series, and case reports. Studies focusing exclusively on non-ECF fistulas or lacking sufficient clinical detail were excluded. Data were extracted on etiology, classification, management approaches, outcomes, and resource considerations, then synthesized narratively according to the SNAP framework (Sepsis, Nutrition, Anatomy, Plan), with emphasis on HIC versus LMIC disparities.

This narrative review has inherent limitations, including non-systematic search methodology, heterogeneity in study designs and outcome definitions, and a lack of formal quality assessment tools. However, given the scarcity of high-quality LMIC studies and their frequent publication in regional journals outside major databases, a systematic review would have excluded critical evidence needed to document resource-specific challenges. The narrative approach allows inclusion of diverse study types that collectively reveal the real-world constraints shaping ECF management in resource-limited settings.

ETIOLOGY

Enterocutaneous fistulas may occur spontaneously due to underlying diseases or as postoperative complications. Approximately 15 to 20% of these cases arise spontaneously, most often in the setting of inflammatory bowel disease, radiation enteritis, diverticular disease, malignancy, intra-abdominal sepsis, pancreatitis, ischemia, trauma, or perforated ulcers.[7]

In contrast, the majority (approximately 75 to 85%) of cases develop after surgical interventions, particularly procedures performed for malignancy, inflammatory bowel disease, adhesions, pancreatitis, or abdominal wall hernia repair. The contributing factors include anastomotic breakdown, unintentional enterotomy, and inadvertent bowel injury during closure. Mesh-related ECFs are increasingly recognized, regardless of the mesh type or placement technique, and often occur at the periphery, where shear forces or adhesions to metal tacks cause erosion. Multiple prior surgeries, extensive adhesiolysis, and emergency procedures performed under unfavorable physiological conditions (e.g., hypotension, hypothermia, and anemia) further increase this risk. As most fistulas are iatrogenic, prevention through meticulous surgical techniques, adequate preoperative preparation, and careful postoperative care remains the cornerstone of management.[7]

The current literature suggests no major differences in the primary causes of ECFs between HICs and LMICs, with postoperative complications remaining the dominant etiology worldwide. A Nigerian series reported 96.5% of postoperative cases, while data from southern India showed a 95% incidence.[12,13] Similarly, in a Malaysian LMIC hospital, surgery accounted for the majority of cases, with spontaneous closure observed in only 14% of cases and mortality approaching 22%.[14] These findings reinforce the notion that etiological patterns of ECFs remain largely consistent across regions, although resources differ.

One exception particularly relevant to LMICs is tuberculosis (TB). Although uncommon overall, ECF is a recognized complication of intestinal TB, accounting for approximately 2.4% of tuberculous enteritis complications, a rate comparable to small bowel volvulus but lower than bowel obstruction (31.7%) and perforation (4.9%).[15] Despite this relatively low proportion, its clinical relevance in TB-endemic regions should not be underestimated.[8] Case reports illustrate the heterogeneity and severity of presentation, including a spontaneous tuberculous ECF occurring 14 years after a non-tuberculous appendicectomy,[15,] and another associated with iliac bone cortical destruction with a fistulous tract extending from adherent small bowel through bone to the right gluteal region.[16] When TB underlies ECF formation, management is considerably more complex, typically requiring prolonged multidrug antituberculous therapy (6 to 9 months) alongside surgical intervention, such as fistulectomy, bowel resection with anastomosis, or hemicolectomy, and intensive nutritional support.[15-17] This combined approach prolongs hospitalization, increases costs, and further strains limited healthcare resources in LMICs. Thus, even as a relatively rare etiology, it may contribute disproportionately to ECF-related morbidity, mortality, and financial burden in endemic LMIC settings. Importantly, robust population-based data quantifying the proportion of all ECFs attributable to TB in endemic settings are lacking. The available literature is largely confined to case reports and small case series, and no large cohort studies have systematically evaluated TB as a cause of ECF.

CLASSIFICATION

Traditionally, ECFs were categorized as high output or low output. However, this dichotomous system has significant limitations, as output volume alone does not reliably predict prognosis, spontaneous closure, or optimal management strategy. Contemporary expert consensus supports a more multidimensional framework. The ESPEN-endorsed definition and classification of intestinal failure emphasizes functional, temporal, and management-oriented criteria, underscoring that classification should facilitate clinical communication and therapeutic decision-making rather than rely solely on effluent volume.[18] Similarly, surgical literature has explicitly rejected output-only schemas in favor of classifications incorporating anatomical location, underlying etiology, and clinical predictors.[19] These approaches recognize that factors such as fistula anatomy, distal obstruction, presence of sepsis,

Table 1. Classification of Enterocutaneous Fistulas and Their Prognostic Implications

Classification System	Categories	Description / Criteria	Prognostic Implication
Anatomic	-Proximal (includes duodenum and jejunum) -Distal (includes Ileum, colon)	Based on the segment of the gastrointestinal tract involved	Jejunal ECFs[a] have higher output, higher risk of malnutrition, and poorer prognosis than colonic ECFs
Physiologic (Output-based)	-Low-output: <200 mL/day -Moderate-output: 200–500 mL/day -High-output: >500 mL/day	Based on the amount of fistula effluent over 24 hours	High-output ECFs associated with fluid/electrolyte imbalance, sepsis, higher mortality
Etiologic	-Postoperative: Most common (90–95%) -Traumatic -Spontaneous: e.g., Crohn's disease, tuberculosis, radiation enteritis	Based on the underlying cause of fistula formation	Postoperative fistulas dominate globally; spontaneous fistulas often indicate underlying chronic disease

[a] Enterocutaneous Fistulas

nutritional status, and serum protein markers (e.g., albumin and other short turnover proteins) are often more decisive determinants of outcome than output volume alone.[19] Therefore, a composite classification integrating anatomical, physiological, and etiological dimensions provides a more accurate framework for prognostication and management.

Anatomic classification divides ECFs into proximal (gastric, duodenal, jejunal) and distal (ileal, colonic/stercoral, and rectal) types. It also considers the presence of abscess cavities, the length of the fistula tract, and its complexity.[20]

Fistulas may be:
• Simple: Short tract, no abscess, and no involvement of other organs.
• Complex: Associated with abscesses or exposed within disrupted wounds. They are further classified as:
  1. Type I: Associated with an abscess and other organ involvement.
  2. Type II: Opening in a disrupted wound without soft tissue or skin coverage.
Physiologic classification is based on the output volume:
• Low output: <200 mL/24 h
• Medium output: 200 to 500 mL/24 h
• High output: >500 mL/24 h

A higher output is strongly associated with fluid/electrolyte imbalance, sepsis, and poor prognosis. On the other hand, favorable physiologic predictors of closure include the absence of sepsis, adequate nutrition, and a low C-reactive protein to albumin ratio.[20]

Etiological classification categorizes fistulas as spontaneous, postoperative, or traumatic, as discussed in detail in the etiology section.

Because classification reflects both prognosis and therapeutic strategies, it plays a central role in guiding management decisions. Table 1 summarizes the classification of ECFs and their prognostic implications in the literature.

MANAGEMENT
Specific problems critical to the successful management of enterocutaneous fistulas include sepsis control, maintenance of fluid and electrolyte balance, provision of adequate nutritional support, and skin-stoma care. Many patients also experience considerable psychological morbidity during the often prolonged recovery period. Given this complexity, ECF management mandates a multidisciplinary team approach, with specialist nurses, dieticians, pharmacists, radiologists, physicians, and surgeons playing essential roles.[21] In a study of 23 consecutive postoperative ECF cases, adherence to the

SOWATS protocol in conjunction with multidisciplinary input achieved fistula closure in nearly 70% of patients, with mortality (19.1%) mainly attributable to sepsis and malnutrition.[22] Similarly, an analysis of 286 patients with ECF at a tertiary center demonstrated that upper GI fistulas were more likely to resolve without surgery, while mortality was again largely driven by sepsis, underscoring the importance of both infection control and nutritional support.[23]

Such comprehensive models of care are far more achievable in HICs, where advanced infrastructure, technology, and expertise are available. In contrast, resource limitations in LMICs often hinder optimal management. In Uganda, the absence of peripherally inserted central catheters and ICU-based central venous lines limited the use of TPN, forcing clinicians to rely instead on improvised high protein oral or nasogastric diets.[24] Similarly, a qualitative study from South Africa highlighted the challenges faced by critical care nurses in managing ECF, including shortages of staff, consumables, and enterostomal therapy resources; factors that compromise sepsis control, fluid balance, and wound care.[25] This section outlines the essential steps in ECF management while examining the unique challenges encountered in LMICs and contrasting these realities with the standards in HICs.

INITIAL RESUSCITATION

The Salford unit in the United Kingdom introduced the SNAP strategy—Sepsis, Nutrition, Anatomy, and Plan—which emphasizes controlling sepsis and skin complications, optimizing nutrition, defining fistula anatomy, and developing a definitive treatment plan.[26] Using this strategy, gastrointestinal fistula management can yield favorable results.

SEPSIS CONTROL

Sepsis remains the leading cause of morbidity and mortality in patients with ECF. Early recognition and timely infection control are critical management priorities. The pathophysiology is multifactorial: enteric spillage causes localized or generalized peritonitis, while persistent fistula contamination leads to intra-abdominal abscess formation and systemic sepsis. Effective source control combined with appropriate antimicrobial therapy is indispensable for improving survival.[27]

Broad spectrum intravenous antibiotics should be promptly initiated in patients with clinical or biochemical evidence of sepsis, ideally after obtaining cultures. Empiric regimens must cover gram-negative and anaerobic organisms, with adjustments guided by culture results and sensitivity patterns.[28] However, antibiotics alone are rarely sufficient. Radiological or surgical drainage of collections is often necessary to achieve durable source control. Several studies emphasize that inadequate drainage remains a key determinant of ongoing septic morbidity.[29]

Imaging, most commonly contrast-enhanced CT, plays a central role in delineating abscesses or undrained collections. In HICs, interventional radiology enables minimally invasive percutaneous drainage in most patients, thereby minimizing the risks associated with reoperation.[30] In contrast, in LMICs, access to advanced imaging and interventional radiology is limited. This often necessitates open surgical drainage even in high risk patients, which not only increases the perioperative risk but also contributes to prolonged recovery and higher mortality.[31,32] The cornerstone of ECF management lies in aggressive sepsis control through prompt recognition, judicious antibiotic therapy, and effective source management. The contrast between HICs and LMICs lies not in the understanding of these principles but in the capacity to implement them consistently. Addressing these disparities through resource allocation, training, and infrastructure development is crucial for reducing the unacceptably high morbidity associated with fistula-related sepsis in resource-limited settings.

NUTRITION

Nutrition is central to the management of ECF. It provides the caloric and protein support necessary to maintain fluid and electrolyte balance and increases the likelihood of spontaneous closure. Effective nutritional therapy has consistently been shown to reduce morbidity and mortality while improving clinical outcomes.[33] In accordance with the 2023 European Society for Clinical Nutrition and Metabolism (ESPEN) clinical practice guidelines on chronic intestinal failure, caloric and protein targets are determined by metabolic state rather than feeding route. For clinically stable patients, total energy provision is recommended at 25 to 35 kcal/kg/day (Recommendation 37), with adjustment according to clinical condition or measured expenditure where feasible. Protein intake should be 1.0 to 1.5 g/kg/day, increasing up to 2.0 g/kg/day in patients with high output fistulas, significant inflammation, or nutritional depletion to compensate for nitrogen losses and promote wound healing (Recommendation 38). Macronutrient distribution should ensure that carbohydrates provide 50 to 70% and lipids 30 to 50% of non-protein energy (Recommendations 40 and 39, respectively).[18]

In most cases, oral intake alone is insufficient to satisfy these requirements. Therefore, nutrients must be administered enterally via nasogastric or nasojejunal tubes, gastrostomy, jejunostomy, or even fistuloclysis into the distal small bowel. They can also be administered

parenterally through peripheral or central venous access. The choice of route depends on the fistula anatomy, patient tolerance, length of functional bowel, and the output volume of the fistula.[33]

ENTERAL NUTRITION (EN)

EN is an independent factor that favors fistula closure. Success is most likely when at least 4 ft (1.2 m) of healthy bowel is present between the ligament of Treitz and the external fistula opening.[26] The standard practice is to begin feeding within 24 to 48 hours at 20 mL/h and increase it gradually to a maximum of 120 mL/h, depending on tolerance.[34] Compared with parenteral nutrition, EN is associated with reduced infection rates, lower costs, and improved immune function.[35] However, complications such as aspiration, tube misplacement, diarrhea, nausea, vomiting, and obstruction remain possible.[36]

The feeding route should be determined by fistula location, with percutaneous endoscopic jejunostomy indicated for proximal duodenal fistulas and oral or gastric feeding feasible for distal ileal or colonic fistulas.[37] Where possible, fistuloclysis should be considered in patients with ECF, allowing infusion of enteral formula or proximal succus into the distal fistula limb. This approach helps preserve distal bowel function, maintain the gut-liver axis, minimize dependence on parenteral nutrition, and optimize nutrient and electrolyte absorption while the patient awaits definitive surgical repair.[18]

When absorption is adequate, polymeric formulas containing carbohydrates (maltodextrin, corn syrup solids), intact proteins (protein isolates, caseinates), and fats (canola, soybean, or sunflower oils) are commonly used. In patients with malabsorption, elemental or semi-elemental formulas with hydrolyzed macronutrients—such as amino acids, dipeptides, hydrolyzed casein, whey, or soy protein—and medium chain triglycerides (MCTs) are preferred.[37]

However, the feasibility of EN is highly dependent on available resources. In HICs, specialized formulas, nutritional teams, and feeding access devices are widely available. By contrast, such resources are frequently unavailable or unaffordable in LMICs. A retrospective review from the University of Nigeria Teaching Hospital, Enugu, analyzing 82 ECF cases over 11 years, demonstrated that management relied on high-calorie, high-protein oral diets supplemented by nasogastric feeding, delivering up to 3,000 kcal/day. Despite the absence of TPN, acceptable healing and mortality rates have been reported, underscoring that aggressive conservative measures can still yield meaningful outcomes.[10] This finding highlights the adaptability of clinicians in resource-limited environments and the need for innovation when standard therapies are inaccessible.

Total Parenteral Nutrition (TPN)

TPN remains essential for selected patients, particularly those with high output fistulas (>500 mL/day), intestinal obstruction, or when fistula drainage complicates wound care and fluid-electrolyte management.[33] By reversing catabolism, TPN supports spontaneous fistula closure and allows safe delayed surgery if closure does not occur. Standard TPN formulations include glucose, amino acids, and lipid emulsions. The traditional use of soybean oil-based emulsions has shifted toward mixed lipid formulations—including MCTs, olive oil, fish oil, and soybean oil[38]—to minimize pro-inflammatory effects.[33] Recommendation 39 of the ESPEN guidelines highlights that MCTs are rapidly cleared from the circulation and are a key component of balanced lipid emulsions, helping to prevent intestinal failure-associated liver disease.[18]

Long-term TPN is administered via central venous lines; however, it carries substantial risks, including catheter-related bloodstream infections, hyperglycemia, thrombosis, and refeeding syndrome.[33]

The availability of TPN starkly differentiates HIC from LMIC practices. In HICs, patients may remain on TPN for weeks to months under close monitoring by multidisciplinary nutrition teams. In contrast, in LMICs, the absence of TPN often forces clinicians to consider surgical options earlier than would otherwise be ideal. A prospective series from the University of Benin Teaching Hospital, Nigeria, noted that in cases where TPN was not available, surgery was pursued when conservative measures failed to achieve improvement.[39] The very patients who would benefit most from delayed surgery (due to their compromised state) are forced into earlier operation precisely because they lack the resources that would enable safe delay. This illustrates how resource constraints directly shape treatment pathways.

ORAL NUTRITION

Oral nutrition should be initiated once the patient demonstrates tolerance to both fluids and solids. Oral supplements may also be added to increase the caloric intake. However, in some patients, even those with preserved intestinal absorption, oral feeding, particularly with solid foods, may paradoxically increase fistula output and therefore require careful monitoring.[33]

In summary, nutritional management of ECF represents a dynamic balance between patient needs and available resources. In HICs, where both EN and TPN are accessible and can be tailored to individual patients, outcomes are optimized. In LMICs, clinicians often rely on pragmatic strategies, such as modified oral and nasogastric feeding regimens, which can still provide acceptable results when

Table 2. Comparison of Enterocutaneous Fistula Management Approaches in High-Income and Low-/Middle-Income Countries

Domain	High-Income Countries (Hics)	Low- and Middle-Income Countries (Lmics)	Implications
Sepsis Control	Interventional radiology drainage, CT, MRI, & broad-spectrum antibiotics are available.	Limited imaging, frequent need for open drainage, restricted antibiotic access.	Delayed source control, higher mortality.
Nutrition	Multidisciplinary nutrition teams, specialized enteral/parenteral regimens, and the economic feasibility of long-term TPN.	Inadequate or nonexistent TPN*, improvised high-calorie meals, and reliance on oral/ nasogastric feeds.	Increased malnutrition, earlier resort to surgery.
Wound Care	Negative pressure wound therapy (NPWT/VAC) † standard; access to stoma nurses and advanced appliances.	Limited access to wound management, inadequate stoma care resources, and improvised NPWT.	Higher skin complications, reduced quality of life.
Pharmacologic Adjuncts	Octreotide/somatostatin analogues widely available and affordable.	Cost constraints limit use; often unavailable in public sector.	Reliance on conservative care; prolonged hospital stays.
Surgical Options	Timely elective surgery after optimization; access to biological meshes and advanced reconstruction.	Delayed or staged surgery; limited access to meshes, reliance on absorbable/improvised substitutes.	Higher recurrence, hernia rates, and overall morbidity.
System Support	Multidisciplinary teams (surgeons, dieticians, wound nurses, ICU‡, radiology).	Shortages in personnel, intensive care unit beds, and consumables.	Reduced survival and poorer long-term outcomes.

* Total Parenteral Nutrition
† Negative Pressure Wound Therapy/Vacuum-assisted Closure
‡ Intensive Care Unit

delivered aggressively and consistently.[10,39] This contrast illustrates not a lack of knowledge but a gap in accessing resources, highlighting the critical importance of improving nutritional support infrastructure to reduce the morbidity and mortality associated with ECF worldwide.

DELINEATION OF ANATOMY

While clinical features may suggest the likely fistula site, imaging is critical for precise anatomical delineation. Modalities include fistulography, ultrasound, CT, MRI, and endoscopy (such as colonoscopy). A carefully performed water-soluble fistulogram, using fine catheters to intubate all fistula orifices, remains invaluable. When performed by an experienced radiologist in collaboration with the surgeon, it can define the fistula's source, tract length and course, continuity of bowel, presence of strictures or distal obstruction, and associated abscess cavities.[40] CT scanning adds the advantage of visualizing abscesses, surrounding tissues, abdominal wall defects, and musculature integrity. MRI is beneficial in fistulas related to Crohn's disease or malignancy, where it helps assess short bowel and pelvic anatomy.[7]

HIC-LMIC Disparities

In HICs, basic laboratory tests, such as CBC, electrolytes, and lactate, along with advanced imaging, are widely available and integrated into standardized protocols, enabling timely diagnosis and stratification of ECF severity. In contrast, LMICs face profound challenges. Laboratory infrastructure is often constrained by unreliable supply chains, inadequate equipment, and workforce shortages, resulting in delayed or incomplete access to essential investigations, such as electrolytes and lactate.[41] Imaging capacity is even more limited: for example, CT scanner density is fewer than one per million population in many LMICs, compared with approximately 40 per million in HICs.[42] However, there is a paucity of ECF-specific diagnostic data from LMICs. Most available reports derive from broader surgical or gastrointestinal literature, which limits the ability to quantify diagnostic gaps and resulting mortality with precision and highlights the urgent need for dedicated health systems and epidemiological research in this area.

PLAN OF TREATMENT
INITIAL MEASURES

Skin protection and control of fistula output should begin

as soon as the diagnosis is established to minimize excoriation, inflammation, pain, and infection. Low output fistulas may be managed with wet-to-dry dressings or dry gauze, whereas moderate output fistulas generally require an ostomy appliance with adhesive ring paste, powder, or hydrophilic dressings. High output fistulas often necessitate specialized collection devices such as wound managers or pouching systems connected to wall suction.[20]

NEGATIVE PRESSURE DRESSINGS

Negative pressure wound therapy (NPWT) has emerged as a useful adjunct in complex fistulas where standard devices fail. In HICs, NPWT is widely adopted as a standard component of care, whereas in LMICs, its availability is limited, often leading to improvised systems with variable results.[43]

PHARMACOLOGICAL ADJUNCTS

Somatostatin and its analogue octreotide have been studied for their ability to reduce fistula effluent. Evidence shows reduced output and faster closure in favorable fistulas, although they do not consistently improve non-operative closure rates. Their role is more pronounced in high output fistulas, where they help minimize fluid and electrolyte losses and protect the skin. A therapeutic trial may be justified, continuing treatment only if output reduction is observed within three days.[7] Reported drawbacks include immunomodulatory effects, reduced splanchnic and portal perfusion, worsening cholestasis, and high cost. In LMICs, cost constraints often preclude routine use, unlike in HICs, where octreotide is readily available and incorporated into guidelines.[44,45]

DEFINITIVE MANAGEMENT

Conservative therapy for at least four weeks is standard, during which spontaneous closure occurs in up to 30% of cases, usually within four to six weeks. Failure to achieve closure or output reduction after this period necessitates operative planning.[6] Surgery requires prior nutritional optimization, control of sepsis, management of psychological morbidity, and abdominal wall compliance. The goal is restoration of bowel continuity and abdominal wall closure. Surgical strategies include resection with primary anastomosis or staged procedures with diversion, the latter lowering recurrence but exposing patients to multiple surgeries.[7]

Abdominal wall reconstruction is critical to the outcome. Large muscular defects after fistula excision frequently preclude primary fascial closure. Permanent synthetic mesh is discouraged due to high risks of infection and fistulization.[46] Biological meshes were initially promising but are now recognized to carry significant infection and recurrence risks, while absorbable options such as polyglactin mesh lower fistulization rates but predispose to late incisional hernia.[47] In HICs, access to advanced reconstructive materials and expertise allows more consistent outcomes. In LMICs, lack of mesh availability and reliance on absorbable or improvised substitutes result in higher recurrence and hernia rates.[48]

Table 2 provides a comparison of management strategies for ECF in HICs and LMICs, highlighting the unique challenges encountered in each setting.

HIC-LMIC DISPARITIES IN PRACTICE

Although the principles of ECF care: sepsis control, wound protection, nutritional optimization, and timely surgery are universal, their execution differs markedly. In HICs, multidisciplinary teams, advanced wound devices, pharmacologic adjuncts, and standardized perioperative pathways improve closure and survival rates. By contrast, LMICs face persistent gaps: limited access to wound appliances,[49,50] improvised NPWT systems,[43] restricted PN and octreotide use due to cost,[48] delayed surgical planning with higher reliance on staged procedures, and lack of reconstructive options.[50] Systemic barriers, including scarcity of stoma nurses, interventional radiology, and ICU support, compound these challenges, leading to higher morbidity and mortality.[25]

CONCLUSION

Management of ECF has improved considerably in HICs through standardized protocols, multidisciplinary care, advanced wound technologies, and guideline-based nutritional support. In contrast, LMICs continue to face higher morbidity and mortality due to limited access to parenteral nutrition, specialized imaging, and structured care pathways.

Bridging this gap requires practical and scalable solutions. Establishing registry-based data systems in LMICs is essential to generate reliable epidemiological and outcome data. Pragmatic nutritional strategies, such as early enteral optimization, judicious use of parenteral nutrition, and fistuloclysis where feasible, should be prioritized. Cost-adapted wound care approaches and standardized fluid-electrolyte replacement protocols may further improve outcomes in resource-limited settings.

Key take-home messages include the importance of early sepsis control, aggressive fluid and electrolyte management, adequate protein provision, and delayed definitive surgery within a coordinated multidisciplinary framework. Future research should focus on multicenter collaborative studies and implementation-based research to develop context-specific, cost-effective management strategies that can reduce preventable mortality from ECF in LMICs.

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