Intestinal fistulas

Dominic Slade
Nigel Scott

Abstract
An intestinal fistula is a communication between the gut and another epithelial surface. Primary disease of the gut (Crohn's disease, diverticular disease, colorectal cancer, radiation enteritis) can all lead to fistula formation which then requires resection of the diseased bowel to close the fistula. Injury (usually iatrogenic) produces a fistula through normal gut and if circumstances are favourable such an injury can close spontaneously. Some postoperative fistulae will not close spontaneously and they require a systematic approach that eliminates sepsis (S), restores nutrition (N), determines anatomy (A) and leads to a closure procedure (P) - SNAP. Sound abdominal closure is an essential feature of surgery to close an intestinal fistula.

Keywords crohns disease; intestinal fistula; postoperative fistula

An intestinal fistula is an abnormal communication between two epithelialized surfaces. Gastrointestinal fistulas may form between the gastrointestinal tract and the skin (enterocutaneous) or an adjacent viscus (enteroenteral). They may be congenital or acquired. Primary (type-I) fistulas result from an underlying disease affecting the gut wall; secondary (type-II) fistulas occur after injury to otherwise normal gut (Table 1).

Characteristics

A fistula may be simple or complex. Simple fistulas form a short, direct track from bowel to skin. Complex fistulas drain to the skin through long, often multiple tracks via an abscess cavity. In general, simple fistulas have a better prognosis and are more likely to close spontaneously.

Fistulas are described as 'high output' if they produce >500 ml in a 24-hour period. High-output fistulas arise from proximal small bowel and may have a worse prognosis and lower rate of spontaneous closure than low-output fistulas.

Fistulas of the small bowel have a higher mortality and complication rate than colonic fistulas due to their higher output, associated sepsis and malnutrition.
A fistula will not close in the presence of:

- discontinuity of bowel ends
- distal obstruction
- chronic abscess
- mucocutaneous continuity of the fistula with skin
- damaged or diseased residual intestine
- malnutrition
- foreign bodies
- malignancy involving the gastrointestinal tract.

Assessment

Initial assessment should identify the metabolic and nutritional consequences of a fistula, and a strategy formulated to correct them. This may determine the time scale for surgery.
Likely prognosis and strategies to treat the fistula can be formulated from answers to two interrelated questions:

- is the fistula a consequence of pre-existing gastrointestinal disease or due to damage to previously healthy tissue?
- will the fistula close spontaneously or is resection indicated?

The condition of adjacent bowel and any associated sepsis must be known. As a general rule, type-I fistulas require resection of the diseased segment; type-II fistulas have the potential to close spontaneously with conservative management.

Primary (type-I) fistulas of the gastrointestinal tract

Crohn's disease is characterized by full-thickness granulomatous inflammation that is breached by a fissuring ulcer, leading to abscess formation. The fistula tract is established when the abscess breaks through the skin or into an adjacent viscus. Up to one-third of enterocutaneous fistulas of the small bowel are secondary to Crohn's disease, but the proportion is much higher if postoperative fistulas are included.

The terminal ileum is commonly affected in Crohn's disease, so presentation is often with a mass in the right iliac fossa comprising fistulating disease in combination with an abscess cavity. Fistulation at the site of a previous ileocolic anastomosis may also develop, which in turn can involve the second or third part of the duodenum.

The most promising medical treatment for fistulas complicating Crohn's disease is infliximab, a chimeric antibody (75% human, 25% mouse) to tumour necrosis factor-α. Such therapy results in a fistula closure rate of 55% within three months, but the duration of closure is shortlived. Radiological or surgical drainage of an abscess secondary to Crohn's disease may be an effective measure to downgrade intra-abdominal sepsis, but definitive resection of the affected bowel segment with simultaneous drainage will inevitably be required in most patients.

Associated sepsis in Crohn's disease is a key factor in decisions regarding surgical management (see 'Surgical management of inflammatory bowel disease'). The first step should be elimination of intra-abdominal sepsis, while correcting nutritional depletion. This may require primary resection with drainage of the abscess. In a normally nourished patient with a serum albumin >30 g/l, it may be safe to perform resection and primary anastomosis away from the abscess cavity. In patients who are malnourished, with an albumin <30 g/l and with large intra-abdominal abscess cavities, resection should be combined with exteriorization of the bowel ends as an end stoma (see 'Intestinal

Dominic Slade *is a Consultant Colorectal and intestinal Failure Surgeon at Hope Hospital, Salford, UK. Conflicts of interest: none declared.*

Nigel Scott **MD FRCS** *is a Consultant Colorectal Surgeon at Royal Preston Hospital Conflicts of interest: none declared.*

Classification of gastrointestinal fistulas

	Examples	Type	Management
Congenital	Tracheo-oesophageal	I	Resection
Acquired			
Inflammatory	Peptic ulceration	I	Resection
	Crohn's disease	I	Resection
	Pancreatitis	I	Conservative or drainage
	Diverticular disease	I	Resection
Neoplastic	Small bowel	I	Resection
	Colon	I	Resection
	Ovarian	I	Resection
Traumatic	Surgery	II	Conservative or resection
	Penetrating trauma	II	Conservative or resection
	Radiation enteritis	I	Resection
Infective	Tuberculosis	I	Anti-microbials or resection
	Actinomycosis	I	Anti-microbials

Table 1

stomas') and mucous fistula. Laparoscopic resection in patients with fistulating Crohn's disease has been described, but a laparotomy is the most appropriate approach for complex fistulating disease.

Colonic diverticular disease: diverticular disease (see 'Colonic diverticulosis') commonly gives rise to a colovesical fistula between the sigmoid colon and the dome of the bladder; the passage of air bubbles (pneumaturia) or faecal matter (faecaluria) in the urine is highly suggestive. Cystoscopy allows exclusion of a neoplastic lesion in the bladder and may show the fistula, seen as an oedematous patch surrounded by localized inflammation with polyps. A barium enema shows the extent of the diverticular disease and fistula, particularly if barium is also detected in the urine.

Segmental resection of the diseased bowel is curative and it is uncommon to find a bladder defect requiring surgical repair. Postoperative management should include an indwelling urinary catheter left *in situ* for ten days. Colovaginal fistulas secondary to diverticular disease may develop in women who have had a hysterectomy, and resection is indicated.

Malignant intestinal fistulas: colorectal cancers may fistulate into any adjacent viscus, producing urinary, enteral, vaginal or cutaneous fistulas.

Preoperative evaluation using examination under anaesthesia, cystoscopy, colonoscopy and multiple imaging methods allows the planning of radical clearance with curative intent. Malignant fistulas from locally advanced colonic cancer are not necessarily indicative of a poorer prognosis, and radical excision in the absence of nodal metastasis may offer a good chance of cure. Fistulas resulting from diffuse inoperable malignancy should be treated by non-surgical palliative means.

Necrotizing pancreatitis: gastrointestinal fistulas arise against a background of necrotizing pancreatitis through damage to the distal pancreatic duct with associated proximal stricture formation or through attempts to drain a pseudocyst percutaneously or transgastrically. Collateral damage to the small bowel or colon with subsequent fistula formation may also follow multiple pancreatic necrosectomies.

Therapy using octreotide (somatostatin analogue) to reduce exocrine secretions and the maintenance of nutrition may lead to spontaneous closure of a pancreatic fistula. Occasionally, surgical resolution may be achieved by fistula drainage into a jejunal Roux loop.

Radiation enteritis: radiotherapy has a major part in the treatment of gynaecological, rectal, and genitourinary malignancies. Radiation enteritis, characterized by an obliterative endarteritis and a reduction in the number of actively dividing cells, may not be apparent for years after completion of treatment. It can cause stricture formation and intestinal fistulation (usually enteroenteral).

The prognosis for radiation fistulas is poor; they rarely close with conservative management. The only effective strategies are surgical and these are associated with significant morbidity and mortality. Constructing a loop stoma proximal to the fistula is the simplest and safest strategy in high-risk patients. If resection of the diseased segment and anastomosis is attempted, it must involve bowel that has been spared from the radiation field; postoperative death, permanent stomas, intestinal failure, refistulation, and intra-abdominal sepsis are common complications.

Secondary (type-II) fistulas of the gastrointestinal tract

Secondary fistulas are the most common type of fistula encountered in surgical practice. Risk factors include those associated with anastomotic failure (e.g. age, nutritional status, site of anastom-osis) as well as peritonitis, hepatic or renal insufficiency, previous surgery and immunocompromise.

Secondary fistulas arise in normal gut usually after laparotomy; they occur as a result of unrecognized enteric injury; or breakdown of an anastomosis or repaired serotomy. The abdomen can be left open as a laparostomy in cases of severe widespread abdominal sepsis or for delayed closure (Figure 1), and is associated with a spontaneous fistula rate of up to 25%. In general, fistulas that occur within laparostomy wounds do not close spontaneously because healing of the abdomen by secondary intention leads to mucocutaneous continuity of the fistula.

Secondary fistulas may also arise in association with a prosthetic mesh following repair of large defects of the abdominal wall. The principles of fistula management should be followed in these patients, but the associated sepsis can often be eliminated only by mesh removal.

Presentation depends on the degree of associated sepsis; a low-volume leak walled off from the peritoneal cavity may produce only minimal systemic upset and discharge of enteric contents through the abdominal wound. Alternatively, the presentation may be with peritonitis, multiple organ failure, and

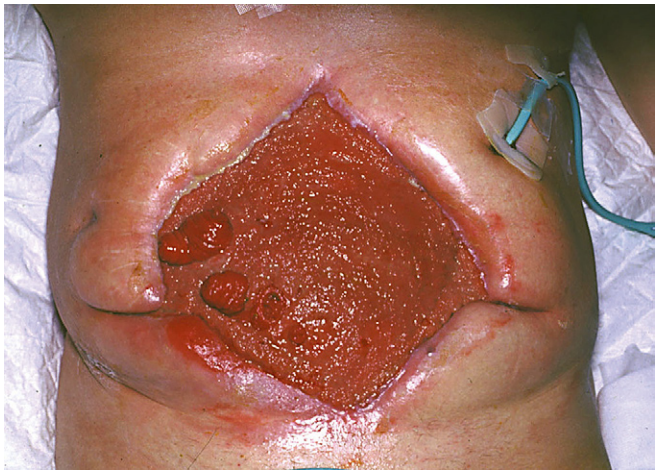

Figure 1 Granulating laparostomy wound with multiple fistulas of the small bowel.

complete dehiscence of the abdominal wound with discharge of large volumes of enteric fluid. The absence of severe systemic sepsis indicates that the fistula is well localized and may heal spontaneously.

Management

The overriding principle of management is rigorous elimination of sepsis by the most appropriate means, with effective, complication-free nutritional support.

Resuscitation: initial treatment aims to correct fluid depletion and sepsis. Resuscitation with attention to **a**irway, **b**reathing and support of the **c**irculation (ABC) follows the same lines as any critically ill patient. Transfer to a HDU or ICU may be necessary to support organ dysfunction. Fluid resuscitation should aim to replace sodium-rich losses from the fistula (sodium content of enteric fluid is about 110 mmol/l) with equivalent volumes of Hartmann's solution or 0.9% saline. Measurement of losses of urinary sodium and volume may help to assess resuscitation. Patients with peritonitis require stabilization and surgical exteriorization of bowel ends to manage uncontrolled intra-abdominal enteric leaks.

Attention to wound care is essential to protect the surrounding skin from destruction by the enteric contents; the fluid must be collected for accurate measurement of losses. This can be time-consuming and requires dedicated nursing resources. The morale of the patient, relatives and staff requires attention for what may be a difficult, long-term problem.

Restitution involves returning the patient to a state from which fistula closure may occur spontaneously or surgically. It requires attention to 'SNAP':

- elimination of **s**epsis
- effective and complication-free **n**utrition
- delineation of the **a**natomy of the fistula (as well as the proximal and distal gut)
- plan surgical resolution or wait for spontaneous closure.

Sepsis results from incompletely localized enteric contents discharging from the fistula. Sepsis prevents healing and leads to multiple organ failure; sepsis drives catabolism, rendering nutritional support ineffective and compounding the malnourished state. Sepsis must be located and eliminated. CT using intravenous and oral contrast is the most valuable tool for baseline evaluation. Isolated collections may require only percutaneous drainage except in cases where fistulating gut is feeding the abscess. In this situation, laparotomy is required and three surgical strategies must be considered:

- resect the fistula and exteriorize the ends
- left upper quadrant laparotomy with diversion of enteric contents to a high-loop jejunostomy
- formation of a laparostomy if bowel cannot be exteriorized after multiple laparotomies in ICU patients.

Complex fistulas or persistent postoperative sepsis are indications for resection of the fistulous segment and drainage of the abscess cavity. In this early stage of management, a primary anastomosis (even if covered by a proximal loop stoma) is at risk of refistulation, hence an end stoma with mucous fistula is a much safer strategy.

If widespread intra-abdominal collections are excluded on CT, the formation of a loop jejunostomy proximal to the fistula through a left upper quadrant laparotomy can control sepsis and thereby avoid a full laparotomy with its attendant risk of further enterotomy. However, this approach immediately precipitates intestinal failure, with stoma losses as high as 4 l/day.

If there are multiple enterotomies in a gut fixed within the peritoneal cavity, formation of a laparostomy allows multiple abscesses to drain and salvages patients with multiple organ failure in the ICU setting.

Nutrition – malnutrition is a constant feature in high-output fistulas associated with persistent sepsis, and impairs utilization of substrates. Parenteral nutrition as a therapy allows a steady supply of nutrients while 'resting the gut'.

Enteral nutrition is the preferred route of administration if the patient has sufficient accessible functioning gut. In proximal enterocutaneous fistulas with accessible distal bowel shown to be of sufficient length and integrity by a distal contrast study, 'tube feeding' the distal gut (fistuloclysis) is a useful technique. Fistuloclysis can also be used for feeding down the distal limb of a proximal jejunostomy brought out as part of sepsis elimination in the early stages of fistula management (Figure 2). Fistulo-clysis allows weaning from parenteral nutrition and also prevents mucosal atrophy associated with defunctioned gut, aiding subsequent surgical adhesiolysis, reconstruction and anastomosis.

Figure 2 Fistuloclysis. A small bowel fistula is fed via a catheter through a stoma bag.

Reduced oral intake with total parenteral nutrition decreases output volumes from fistulas considerably. Parenteral nutrition must be used if enteral feeding cannot be established due to intestinal failure. A typical regimen is 9 g of nitrogen and 1400 calories with suitable additives and electrolytes. Feed administration should be over a nocturnal 12-hour period to allow mobilization during the day.
Complications of parenteral nutrition are:

- catheter placement (e.g. pneumothorax, vascular injury)
- catheter care (e.g. sepsis, endocarditis, thrombosis, occlusion)
- metabolic (e.g. hepatic dysfunction—excessive administration of calories).

The anatomy of a postoperative fistula is ascertained through contrast studies looking at proximal and distal bowel, along with direct injection of contrast into the fistula track (fistulogram). It is important to:

- establish the relationship of the fistula to the remaining bowel
- determine if distal feeding can be initiated
- exclude distal obstruction
- determine if an abscess cavity is present
- determine the presence of residual disease that may prevent spontaneous closure of the fistula.

Plan or procedure is heralded by the successful elimination of sepsis and malnutrition, and the clear delineation of the anatomy of the fistula and remaining bowel. Spontaneous closure is less likely if colorectal cancer, residual Crohn's disease or radiation enteritis is present. Spontaneous closure often occurs within six weeks of the initiation of total parenteral nutrition in up to 70% of patients; it is likely that surgical reconstruction will be required if there is no evidence of closure within this time.

Reconstruction is challenging; the key components are:

- access to the peritoneal cavity
- anastomosis of the gastrointestinal tract
- abdominal closure.

Early surgery should be avoided unless it is to drain sepsis, raise a stoma, resect ischaemic bowel or to exteriorize a fistula. Access to the peritoneal cavity requires its reconstitution from the obliterative phase seen after intra-abdominal sepsis, fistulation and surgery. This takes up to six months and can be assumed clinically by the prolapse of fistulas through the abdominal wall (Figure 3).

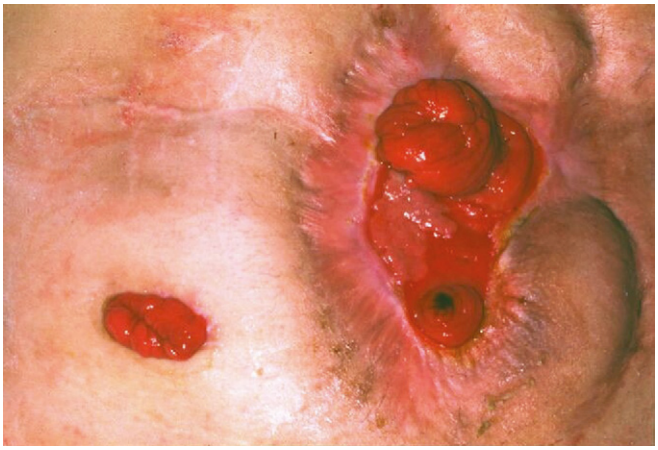

Figure 3 Healed laparostomy wound with prolapsing fistulas, indicating that the peritoneal cavity is re-established.

After entering the abdomen, the entire bowel from the duodenal-jejunal flexure to the rectum should be dissected free to allow location of the fistula and to exclude distal obstruction. A standard sutured anastomosis is done in one or two layers after resection of the fistula and any diseased bowel.

Abdominal closure is essential after fistula reconstruction to cover the anastomosis and prevent the suture line from breaking down and refistulating. Relaxing incisions and suture techniques (e.g. 'near and far' closure) help to bring the large defects of the abdominal wall together.

Rehabilitation: postoperative fistulas that resolve spontaneously may add only a few extra weeks to hospital stay. Postoperative fistulation associated with life-threatening illness, prolonged stays in the ICU with multiple organ failure, and repeated surgery have considerable impact on the well-being and mental state of the patient, his family and friends. Adjusting to the prolonged illness and alteration in body image that accompanies postoperative fistulation requires specialized nursing care and support. ◆