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FECAL FISTULA: WHAT IS NEW?

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Fecal (or enterocutaneous) fistulae present the surgeon with fascinating challenges because of their combination of anatomic abnormalities, metabolic disorders and extensive sepsis. Total management of an intestinal fistula requires skill in nutritional support, stoma therapy, elimination of sepsis, well timed, and well carried out surgery.(1)
Gone are the days when the intestinal defect was tackled by an early surgical attempt at closure. Such an approach was almost invariably followed by immediate recurrence and a high death rate. Instead, today`s patients with fecal fistula are treated by sustained enteral or parenteral nutritional support, which allows the fistula to close spontaneously in 70% to 80% of cases. Even if this does not occur, the patient is rendered capable to face further surgical procedures.(2)

Definitions:

A fecal fistula can be defined as discharging of fecal matter from any orifice other than the anus. It is an abnormal communication between two epithelialised surfaces. Since transient drainage of intestinal contents may accompany removal of enterotomy tubes such as jejunostomy, fecal fistula is considered only in whom drainage of intestinal contents persists for more than 48 hours.(3) The communication is usually formed by granulation tissue, but in some cases it may be lined by epithelium.(4)
The discharge from a fistula connected with the duodenum or jejunum is bile stained and causes severe excoriation of the skin. When the ileum or caecum is involved, the discharge is fluid fecal matter, and when the distal colon is affected, it is solid or semisolid matter.(5)
Anatomic, physiologic and etiologic classifications are most useful to the surgeon charged with the care of patients with these difficult problems.

Anatomical classification:

Fistulae are classified into:
Simple, when there is a single direct tract or
Complicated, when there are multiple tracts or when associated with an abscess cavity.
They also may be:

Lateral fistulae when arising from the side of a hollow viscus or
End fistulae when they arise from the whole circumference of the involved bowel and when there is no further continuity of the gastrointestinal tract.(6)

Anatomic information has prognostic significance with regard to spontaneous closure of the fistulous tract as well as it helps narrow the differential diagnosis with regard to the etiologic process underlying fistula formation.(7)

Physiologic classification:

Fistulae are classified according to the 24 hours output into:
Low output (< 200 ml/ 24 hours).
Moderate output (200 – 500 ml / 24 hours)
High output (> 500 ml / 24 hours).(8,9)

Etiologic classification:

Etiologic classification is predictive of spontaneous closure and independently predictive of patient death.(10) The etiology of intestinal fistulae is classified into:

1. Congenital: Developmental errors may result in both external and internal fistulae. The best-known examples are the rectovaginal and rectovesical fistulae in association with anorectal agenesis. Rarely, completely patent vitello-

intestinal duct will produce an umbilical fistula discharging small intestinal contents.[11]

2. Acquired:

- **Traumatic:** Both closed and penetrating abdominal or perineal trauma can cause injury of the gut. Penetrating injuries are almost always explored because of signs of peritonitis or hemorrhage, and the injured gut is detected and treated. A fistula may develop due to breakdown of an ill-advised closure of a traumatic wound or from a primary anastomosis following resection.[12] However, in closed trauma, visceral rupture may remain unrecognized until it presents as an abdominal abscess which on drainage, discharges enteric contents. This is particularly the case in retroperitoneal rupture of the colon.[13]

- **Inflammatory:** Several inflammatory conditions such as tuberculosis, anastomotic ulcer, inflammatory bowel disease, diverticular disease and appendicitis can cause intestinal fistula.

In industrialized countries, the commonest inflammatory cause of fistulae is Crohn`s disease.[14] The transmural inflammation leads to adherence of the involved bowel segment to adjacent structures. Micro-perforation then leads to abscess formation, which subsequently penetrates into another viscus. Usually, this is a loop of bowel, urinary bladder, or vagina. Less frequently, it emerges through the skin of the anterior abdominal wall.[10]

In colonic diverticular disease, inadequate resection of the colon involved with diverticulae can lead to colonic fistulae if the disease process recurs.[15] Rarely, colocutaneous fistulae arise from the appendix. Such fistulae occur after percutaneous drainage of an appendiceal abscess.[16] Fistulas that occur after appendectomy in a patient subsequently found to have Crohn`s disease are usually not from the appendiceal stump, but arise from the terminal ileum where the active Crohn`s segment adheres to the healing abdominal suture line.[7]

- **Malignancy:** Malignant tumors frequently invade adjacent viscera resulting in internal fistulae. Rarely such tumors produce external fistulae either by direct invasion of the abdominal wall or by obstruction with proximal perforation and abscess formation. A fistula develops when the abscess perforates through the abdominal wall or when it is surgically drained.[17,18]

- **Radiation enteritis:** Radiation enteritis following abdominal or pelvic radiotherapy also, leads to perforation of the gut by an indirect mechanism through the formation of oxygen free radicals from the intracellular water. As a result, lipid membranes undergo peroxidation with subsequent alteration of membrane fluidity and permeability, which lead to further damage to the gut. Also, the resultant obliterative arteritis causes bowel ischemia and subsequently fibrosis, rigidity and mucosal atrophy. These changes can then evolve into stricture, perforation and fistula formation. These may not present until several years after the initial exposure.[19] Colonic fistulae due to radiation therapy most frequently present with rectovaginal and rectovesical fistulae.[20]

- **Surgical:** 75% to 85% of enterocutaneous fistulae are due to postoperative causes. These causes include disruption of the anastomotic suture line, inadvertent enterotomy, or inadvertent small bowel injury at the time of abdominal closure. Roughly, half are thought to be due to anastomotic failure, and half are due to inadvertent enterotomy.[21]

Fistulas commonly occur in settings of emergency surgery, for which patient preparation has been poor or when the patient is chronically malnourished. Some of the factors that predispose a patient to a postoperative entero-cutaneous fistula formation is within the control of the surgeon.

Use of healthy bowel to perform an anastomosis well away from an inflamed or a diseased tissue, preoperative mechanical bowel preparation, preoperative intraluminal or systemic antibiotics, a tension-free anastomosis, meticulous haemostasis, secure abdominal wall closure, maintenance of adequate oxygen-carrying capacity in the postoperative period, and preoperative maximization of nutritional status, all lessen the risk of postoperative enterocutaneous fistula formation.[22]

Effects of fistula formation:

The passage of gastrointestinal contents through the fistula can lead to three major problems:
Nutritional disorders due to bypassing the portion of the gut below the fistula so that, preventing it from carrying its normal absorptive function.
Water and electrolyte imbalance due to loss of gastrointestinal secretions.
Serious septic complications if the fistula is not effectively walled off from the surrounding structures with the subsequent escape of enteric contents into a normally sterile area such as the peritoneal cavity.
These factors mostly determine the morbidity and mortality of the intestinal fistula.[23]
There are also less serious but equally unpleasant problems in patients with external fistulae. The discharge of enteric contents onto the skin constitutes a major nursing challenge. If the skin is not properly protected from the start, severe excoriations will take place and subsequent stoma management will be more difficult.[24]

Malnutrition:

The nutritional and electrolyte disturbance resulting from loss of enteric contents are positively related to the extent of the output and the level of the fistula. They are usually more pronounced in high output and proximal fistulae. Moreover, increased energy expenditure, resulting from the presence of the fistula and its complications, as well as the catabolic effects of sepsis are contributing factors.[25] In this condition where there is decreased intake and increased energy output, the body stores of glycogen and fat are progressively depleted in addition to the muscle proteins which is progressively catabolised for energy. This explains the wasting and hypo-albuminemia frequently associating intestinal fistulae.[26]

Sepsis:

Sepsis is the major problem in patients with intestinal fistulae and when uncontrolled, it is the principle cause of death.[27] The associated toxemia and circulatory disturbances can lead to organ system failure involving the liver, kidney and lungs and consequent high mortality.[28]
In the majority of cases, the cause of infection is the presence of an intra-abdominal abscess. Other forms of sepsis may be due to wound or chest infections or the presence of infected indwelling intravenous or urinary catheters.[3]

Management protocol for intestinal fistulae:

Attempts at early surgical closure were associated with high mortality rates. Advances in electrolyte replacement and nutritional support measures have allowed surgeons to maintain patients with intestinal fistulae in a good condition until the fistula closes spontaneously or the patient becomes fit for a definitive surgical correction.[29]

[30]suggested a four-phase approach that could successfully put management priorities in order. This approach has stood the test of time and remains, with modifications, the basis for management of enterocutaneous fistulae.[11]

Phase I: Resuscitation and skin protection:

Resuscitation:

The first stage of management of a fecal fistula is to correct hypovolaemia and restore fluid and electrolyte balance. This could be achieved by using plasma substitutes or even actual blood transfusion if there is an evidence of blood loss. Saline containing potassium is infused until vital signs return to normal and an adequate urine volume is obtained. Once balance is achieved, infusion of water and electrolytes is continued in quantity sufficient to provide the patient`s normal daily requirements plus the estimated losses through the fistula.[31]

Protection of the skin and collection of fistula effluent:

Skin protection measures should be applied as soon as the fistula is recognized for if excoriation takes place, subsequent skin management becomes difficult. The aim is to apply effective skin protectives and a disposable drainage bag which will collect the effluent and allow its accurate measurement.

[32], classified skin problems associated with external intestinal fistula into four categories as follows:

Category I:

A single orifice passing through an intact abdominal wall or a healed scar around which the skin is flat and in a good condition.

Category II:

Single or multiple orifices passing through the abdominal wall close to bony prominence, surgical scars, other stomas or the umbilicus.

Category III:

Fistulae presenting through a small dehiscence of the main wound.

Category IV:

Fistulae presenting through a large dehiscence or at the bottom of gapping wounds.

Management:

Category I: Once the fistula is recognized, the skin around the mouth of the fistula should be treated with a silicon barrier preparation such as Skin Gel and allowed to become tacky. A flat adhesive drainable bag is then applied. The hole in the adhesive should be fashioned as closely as possible to the shape of the mouth of the fistula in order to afford maximum skin protection. In high output fistula, a Stomahesive is ideal in this respect and should be used beneath the same type of flat-flanged bag.
Category II: Patients may present with severe skin excoriation on which it is impossible to get any appliance to adhere. It is occasionally helpful to nurse such patients face down on a split bed for up to 48 hours in order to allow the effluent to escape without contacting the skin allowing it to recover. The best approach to category II fistulae is to use large sheets (20X20 cm) of Stomahesive cut to fit around the various holes in the abdominal wall and a large bag is then applied to cover the defect.
Category III: Skin protection using Stomahesive wafers remains the principle method of management. A large-sized protective wafers is cut or two wafers are used to cover the skin on both sides of the defect after which a large bag is applied to cover the defect to be replaced by a smaller one as soon as possible.
Category IV: Fistulae in the depths of a major wound dehiscence present a major problem. They are best managed by low-pressure suction drainage to remove the effluent. This is continued until the wound shrinks to a size that can be managed by the technique described in category III. Sump drains are ideal for initiating treatment.

There are occasional cases where control may only be achieved by diverting the fecal flow proximal to the fistula.[11]

Phase II: Institution of nutritional treatment:

The aim of this phase is to provide adequate and sustained nutritional treatment in order to maintain the patient until the fistulae close spontaneously or to make the patient fit for surgery.

In a patient with a suspected enterocutaneous fistula, it is recommended to stop all forms of oral intake because feeding stimulates further losses of fluids, electrolytes, and proteins, which further exacerbate the patient nutritional status.

Parenteral nutrition should be commenced in patients with high output or proximal fistulae for 48 hours from the onset of the fistula. If subsequent investigations reveal a reasonable length of functioning small bowel (> 100 cm), proximal or distal to the fistula, it may be possible to phase in enteral regimens.[1]

Nutrient requirements of patients with enterocutaneous fistulae:

Water requirement based on caloric expenditure (1ml/kcal/24hs) is the most practical because, in general, 1ml of water is needed for each expended calorie. Factors that significantly increase water and energy needs include loss of GI fluids, fever and sepsis.

The usual daily requirements of sodium, potassium, and phosphorus should be given during enteral or parenteral nutrition because this helps the anabolic retention of other elements including nitrogen.[33]

In clinical practice, caloric needs to meet basal metabolic expenditure (BME) are calculated using the Harris-Benedict equations. These predictive equations are based on height (H), weight (W), age (A), and gender of normal adults:

For men:

BME (kcal/d) = 66.4730 + 13.7516 (W) + 5.0033 (H) – 6.7550 (A)

For women:

BME (kcal/d) = 65.5095 + 9.5630 (W) + 1.8596 (H) – 4.6756 (A)

In highly stressed patients, only glucose significantly suppresses gluconeogenesis. Hence, parenteral glucose should constitute the major caloric source in TPN and the rest of the calories should come from fat. Protein calories are usually not included in calculations of daily caloric intake. Protein requirements, such as amino acids for intravenous feeding are the same as those for normal oral feeding.[31]

Standardized TPN order form:

This form is based on the single delivery system of the Three –in -One mixture concept that offers the following features:

- A standard formula concentration (70g of glucose. 15g of amino acids, and 30g of lipids /1000 ml).
- The average daily recommendations for electrolytes, vitamins and trace elements.
- Addition of heparin to prevent catheter thrombosis.
- Addition of weekly vitamin K.
- Option to add insulin and H2 receptor blockers.
- Laboratory tests to monitor the patient`s immediate and long-term tolerance to TPN.[34]

Venous access for TPN:

- **Central venous cannulation:**
  Two routes are commonly used:
  Infraclavicular subclavian vein.
  Supraclavicular internal jugular vein.
  Both routes are popular and permit the delivery of hypertonic nutrient solutions in a dependable manner for long times.[35,36]
- **Right atrial catheters:**
  Centrally placed Hickman catheters. They are placed via either the superior or inferior vena cava. They are more versatile devices for long-term venous access for patients requiring TPN. In addition, the double lumen catheters permit the simultaneous infusion of blood products and the frequent drawing of blood.
  Numerous studies have shown that the infectious complications are infrequent even in the immunocompromised patients.[37]

Enteral nutrition:

Enteral regimens are indicated for patients with low output external fistulae such as those associated with Crohn`s disease or distal fistulae arising at or below the terminal ileum. It may be possible to use enteral regimens in patients with high output external fistulae if investigations prove there is a reasonable length of bowel below the fistulae.[38]

Elemental diets are formed of amino acids or oligopeptides, triglycerides or simple sugars and are stated to be totally absorbed from 150 to 250 cm of small bowel thereby, leaving no residue. Current generations of enteral diets are superior to current parenteral solutions because they contain glutamine, arginine, fish oils, nucleosides and nucleotides. These nutrients have been shown to have beneficial physiologic effects in supporting GI mucosal growth and function important for critically ill patients in whom the gut mucosal barrier may become compromised.[39,40]

In patients with distal fistulae, the enteral regimens can be drunk. However, the prolonged intake of these liquid regimens is usually difficult to tolerate. It is possible to make these preparations more acceptable either by dilution, changing their flavor or presenting them as jellies or ice-lollies.[11]

Techniques of access to GIT for enteral feeding:

Nasogastric:

When the GI tract is functioning but the patient will not or cannot eat, then tube feeding should be used. Nowadays, smaller Silastic nasogastric tubes with weighted tips are available and are well tolerated by most patients.[41]

Gastrostomy:

In the patient undergoing GI surgery, the advantages of a tube gastrostomy for feeding purposes include easy access to the stomach and bypassing of more proximal mechanical, surgical or functional obstruction of the esophagus.

Jejunostomy:

If an operation is required to drain localized infection in a patient with an enterocutaneous fistula, placement of a feeding jejunostomy should be considered. This becomes very useful to deliver enteral nutrients during recovery. Thus avoiding some of the recognized disadvantages associated with the use of TPN. Both the Jejunostomy and the gastrostomy are usually placed at the time the patient needs further intra abdominal exploration for GI fistula. The size of the catheter is usually relatively small (no. 8f to 12f) and its use is indicated when there is a proximal obstruction or fistula in the GI tract, in the absence of a stomach or when recovery of small bowel motility is anticipated long before recovery of gastric motility.[31]

Phase III: Investigations and continuing nutritional treatment:

Once nutritional treatment has been established, thorough investigations can be started in an attempt to answer the following important questions:

- What is the origin of the fistula? And the anatomy of its tract?
- What is the condition of the bowel at the site of the fistula? Is there discontinuity of bowel or active disease such as Crohn`s disease or malignancy?
- Is there an obstruction distal to the fistula?
- How much normal bowel is available for enteral nutrition?
- Is there an associated abscess cavity?

Answering these questions is essential for the formulation of the management plan. Besides clinical assessment, a series of biochemical, hematological, radiological and endoscopic studies will be required.[11]

Clinical assessment:

The diagnosis of the presence of an external fistula is rarely a problem. The majority follow surgical operations and the patient`s history will be well known. Postoperative fistulae may develop from a few hours to several days after operation. Initially, the patient may become feverish, tachycardic, and have abdominal tenderness and localized rigidity. This is followed by discharge of enteric contents through the wound or at the site of a drain. There may be some immediate improvement in the patient`s condition but such improvement is usually temporary and soon the signs of dehydration and malnutrition become manifest.

Patients with colovesical or rectovesical fistulae present with suprapubic pain, pneumaturia, fecaluria, bacteriuria, pyuria and chronic urinary tract infection. Colovaginal fistulae present with vaginal discharge. The volume and character of the discharge vary from a stain to profuse fecal drainage.[42]

Radiological studies:

In the pre-CT and ultrasonography era, plain radiography, contrast GI studies, fistulograms, and the radionuclide gallium scan were the primary imaging techniques used by radiologists to diagnose and investigate GI fistulas and their complications, such as abscess formation. Plain radiography and gallium scanning have been replaced by the more sophisticated imaging modalities of CT and ultrasonography.[43]

Fistulography:

The value of fistulography using water-soluble contrast medium has long been appreciated by general surgeons.[44] Catheterization of the fistula mouth is carried out and the contrast medium is then infused and observed under the fluoroscope. This will demonstrate the anatomy of the track and show other significant features such as abscess cavities. If a fistulogram fails to delineate the cause of sepsis, additional diagnostic imaging techniques such as CT or GI contrast studies should be used for further investigation.[45]

Barium contrast studies:

These contrast studies are valuable in the diagnosis of internal fistulae and high output external fistulae. Small bowel fistulae are better demonstrated by intubation of the upper small bowel and infusion of diluted barium (small bowel enema). This method is certainly more effective than

conventional follow-through techniques. For colonic fistulae, a barium enema is essential and should be undertaken using the air contrast technique.

Contrast studies are also valuable in demonstrating the length of the remaining bowel, the extent of any underlying disease and the presence of obstruction distal to the fistula.[46]

It is wise to take films of the abdomen 24 to 48 hours after completion of the study as this may show contrast remaining in an abscess cavity.[11]

Endoscopy:

Proctoscopy and colonoscopy though not usually helpful in demonstrating fistulae, are usually very successful in revealing the underlying disease and allowing biopsies to be taken for histological examination. Sometimes, an enterocolic fistula due to an underlying disease such as Crohn`s disease is marked by an inflammatory polyp in otherwise normal mucosa.

For colovesical fistulas, cystoscopy is diagnostic or very suggestive in 80% to 100% of cases. In some cases, attempts at endoscopy are frustrated by the rapid escape of air through the fistula.[47]

Detection of abscess cavity:

Clinical evaluation: Although several advanced investigative techniques are available, clinical evaluation remains the most valuable method for detection of intra-abdominal abscesses. Pain, pyrexia, leucocytosis and palpable tender swellings often provide sufficient evidence of the presence of an abscess.

Ultrasound scanning is a valuable investigative technique when searching for intraperitoneal abscesses but even when there is a negative ultrasound examination the presence of a strong clinical evidence of an abscess, should stimulate the initiation of other methods of investigations. False negative ultrasound examination may occur when abscess cavities contain gas in which case they can be mistaken for loops of bowel.[48]

C.T scanning is undoubtedly the most reliable method in detecting abscess cavities and unlike ultrasound, enables the surgeon to see the lesion and delineate its anatomical boundaries. Moreover, C.T combined with catheter and guide wire techniques have allowed the development of highly effective percutaneous methods to deal with most GI fistulae and associated intra-abdominal and pelvic abscesses. The percutaneous abscess drainage (PAD) technique is a less invasive approach to patients and significantly decreases morbidity and mortality for patients who are candidates for treatment using the percutaneous approach.[48,49]

Isotope scanning Indium111 - labeled leucocytes can be of value where other methods of detecting abscesses have failed. The major advantage of using scintigraphy is that it can accurately distinguish between fibrosis, scarring and active disease especially in chronic diseases such as Crohn`s disease.[50]

Phase IV: Definitive treatment plan:

In those cases where there is a walled off external fistula, conservative treatment in the form of sustained nutritional support and stoma care should be instituted and maintained until spontaneous closure occurs or until it is obvious that this will not be achieved.

The question of for how long conservative treatment should be continued is usually answered by the behavior of the fistula. If the patient is improving with a decrease in the fistula effluent, and an increase in plasma albumin and body weight, conservative treatment is continued without time limit.[3] However, if there are no signs of spontaneous closure within 4 - 6 weeks of instituting effective nutritional treatment operation should be undertaken to close the fistula.

Recently, the long half-life analogue of somatostatin (octreotide) has been used to treat enterocutaneous fistulae. Using octreotide 100 microgram /8 hours subcutaneously is reported to decrease fistula output by an average of 55% within the first day. Also, the use of TPN and octreotide was reported to be associated with a 77% spontaneous closure rate after an average of 5.8 + 2.7 days compared with 4-6 weeks of TPN alone, suggesting that octreotide itself can shorten the length of hospitalization and the subsequent overall morbidity of enterocutaneous fistulae.[51,52]

However, if the condition is associated with a generalized peritonitis or an associated abscess cavity, urgent operative treatment should be instituted as soon as the problem has been demonstrated.[11]

Failure of spontaneous closure:

It is recognized that some diseases are associated with a low rate of spontaneous closure (Crohn`s disease and radiation enteritis) and such conditions will nearly always requires surgical closure. Additionally, the following circumstances will always need operative intervention:

- Total discontinuity of the bowel ends.
- Distal obstruction.

- Muco-cutaneous continuity or an epithelialised fistulous tract.
- Complicated fistulae that drain to the surface through an abscess cavity.
- The presence of an active disease at the site of the fistula such as Crohn`s disease or malignancy.

Management of complications of intestinal fistulae:

Infection:

Antibiotics are indicated only for the treatment of septicemia, spreading cellulites and infection of normally sterile systems such as respiratory and urinary tracts.
Antibiotics should not be used for the treatment of discharging wounds unless there is associated cellulites.(53)

Open wounds are inevitably contaminated by the fecal discharge from the fistula and antibiotics do not have any beneficial effect in such circumstances.

For intra-abdominal abscess, drainage of pus is essential either surgically where the abscess cavity is digitally explored and totally evacuated following, which a large drainage tube should be inserted to ensure continued adequate drainage or by the more recently percutaneous abscess drainage (PAD) guided by the C.T scan. The latter technique is a less invasive approach to the patient and significantly decreases morbidity and mortality for patients who are candidates for such technique.(49)

Hemorrhage:

Bleeding in patients with intestinal fistulae commonly arises from either erosion of a blood vessel by abscess cavity or stress ulceration due to associated severe sepsis. Septic patients with external fistulae should be on H2 receptor antagonists until the fistula closes. Occasionally, the hemorrhage may result from the underlying disease such as peptic ulcer or neoplasm.

Secondary hemorrhage associated with an abscess cavity should be treated by drainage of the abscess and packing of the resulting cavity.(11)

Principles of surgical operation for the management of intestinal fistulae:

Operations for the treatment of intestinal fistulae fall into two major groups:

- Those designed to improve the patient condition rather than closing the fistula e.g. drainage of an abscess, insertion of central lines and creation of feeding entero-stomas.
- Operations designed to close the fistula. Such definitive operations are indicated for external fistulae, which fail to close on conservative measures.

Definitive surgery for intestinal fistulae should be governed by the following two general principles:

- Incisions should be extensive and in a virgin area of the abdomen.
- Resection of the fistula and anastomosis should not be undertaken as one procedure in septic, hypo-albuminemia or malnourished patient because of the high risk of anastomotic leakage. Instead, the fistula is resected and the bowel should be exteriorized and when the patient condition is more favorable, the bowel can be re-anastomosed.(54)

In those rare cases where it is impossible to resect the fistula either because it is fixed, such as in malignant fistulae, or if the patient is unable to tolerate a major operation, the bowel can be exteriorized proximal to the fistula either as a split stoma or as a loop stoma.(55)

Surgical management of special fistulae:

Small intestinal fistulae:

Although the general treatment principles have not changed dramatically, the introduction of TPN, somatostatin and percutaneous abscess drainage has decreased the frequency of fistulae requiring surgical intervention.

External fistulae, which are usually symptomatic, spontaneously close in approximately 70% of cases if full supportive treatment is given. TPN, somatostatin, fluid replacement and aggressive prevention/treatment of sepsis are all key parts of non-operative management of external fistulae.

The **mixed fistula** involves two or more hollow viscera and a cutaneous connection. This unusual type of small bowel fistula is almost always associated with an abscess; surgical intervention is the role in these cases, owing to the complex nature of these fistulae and the persistence of infection.(56)
Although most small bowel fistulae arise as a result of surgical procedures, the increasing awareness of Crohn`s disease and other inflammatory bowel disorders has led to a renewed interest in treating these entities and their subsequent complications.
Irving (1983), classified fistulae associated with Crohn`s disease into two types

- Type I: fistulae arising from an area of active Crohn`s disease.
- Type II: those arising from the suture line of an anastomosis following resection of Crohn`s disease.

Type I fistulae will usually require resection of the diseased fistulating bowel, while type II fistulae can be managed conservatively like any anastomotic leakage. Using the general principles described earlier, both types may be successfully treated with a high closure rate and minimal mortality.[57]

Although, intravenous Infliximab (chimeric monoclonal antibody that binds to TNF alpha and neutralizes its effects) infusion was associated with complete or partial response rate in 50% and 61%, it did not supplant the need for surgical intervention in the majority of patients with fistulizing Crohn`s disease.[58,59]

Fecal fistulae resistant to conservative treatment could be endoscopically located and injected through a catheter with 2 - 4 ml of reconstituted fibrin glue, Tissucol 2.0 at 37 degrees C with a high success rate.[60]
A new surgical repair of enterocutaneous fistula associated with abdominal wound defects can be treated by a turn over of fasciocutaneous flap from the surrounding skin by suturing the intestinal lumen directly to the cutaneous side of the flap. The method is a risk-free extra-peritoneal approach that can be performed using local anesthesia.[61]

Colonic fistulae:

In general, colonic fistulae are low output fistulae. Occasionally this may not be true when the fistula communicates with the small bowel. Colonic fistulae typically have fewer complications than any other GI fistulae. Sepsis if present is localized and amenable to surgical treatment.[8]
In the absence of generalized peritonitis, the local infection should be drained and constitutional symptoms should be treated properly, with intravenous antibiotics if necessary. In the absence of any of the conditions that prevent closure of the fistula, spontaneous closure is expected.

The need for more aggressive treatment depends on the extent of inflammation in the region of the leaking anastomosis, the volume of fistula output and the degree of difficulty in controlling the effluent.
Proximal diversion in conjunction with drainage of the abscess is helpful if there is an abscess with a large cavity and more than just a small defect in the anastomosis. It is preferable to perform proximal diversion than to take down the anastomosis and construct an end colostomy. Even if further surgery is necessary for a stricture or residual sepsis, it is more convenient to find the distal end of the bowel ends are in close proximity. The diverting stoma is kept for a minimum of three months and before its closure, clinical examination and radiological investigations are done to check the anastomosis.
If the lumen is smaller than 12 mm, it should be dilated before closure of the stoma.

If the stricture is long and/or less than 12mm in size and unable to be dilated, resection of the anastomosis site with reconstruction of a new anastomosis is indicated.[55]

Fibrin glue has been used successfully in colocutaneous fistulae, and complex rectocutaneous fistulae. Fistulas can be injected via a flexible fiberoptic endoscope with fluoroscopic guidance or directly with a rigid proctoscope. Fibrin glue can be mixed directly from cryoprecipitate, thrombin, and calcium or using a Tisseel kit (Baxter, Deerfield, IL). All fistulas treated by Lamont et al (2002).[62] were obliterated and patients required a mean of one application of fibrin glue (range one to two).

Paul et al (2002),[63] with radiologic guidance placed covered metallic stents in 4 patients with postoperative external colonic fistulae in the rectosigmoid colon and reported fistula resolution in two of them.

Special circumstances:

Colovesical fistula:

This is usually associated with diverticular disease. The majority are well-established mature fistulae with little or no acute inflammation. Nowadays, 3-D CT provides better visualization of the anatomical relationships of colovesical fistulae.[64]

The majority of patients are best treated with resection of the perforated colon and a colorectal anastomosis as a single stage procedure.[65]
The colovesical fistula is taken down by pinching the colon off the bladder. It is essential to remove all the sigmoid colon distally as it is found that 38/93 patients with colocutaneous fistulae due to diverticular disease had a residual distal sigmoid colon.[66] It is believed that leaving distal sigmoid rather than performing a colorectal anastomosis is a major factor contributing to this problem. The proximal line of resection is proximal to all the hypertrophic musculature associated with the diverticular disease.

The bladder is managed by curettage of any pyogenic membrane and allowed to heal. The fistula tract through the decussating muscle fibers of the bladder is usually not demonstrable. It closes with bladder drainage for 5-7 days without suturing.
If there is an associated abscess or acute inflammation, Hartmann`s operation is the safest procedure with later restoration of continuity.[55]
If cancer is present, a partial cystectomy is performed en block with the sigmoid colon . The bladder then must be repaired primarily.[67]

Radiation-associated fistulae:

Radiation-induced fistulae usually develop years after radiation therapy for gynecologic or urologic malignancy. They develop spontaneously after perforation of the irradiated intestine, with development of an abscess in the pelvis, which subsequently drains into an adjacent viscus or the abdominal wall.

These fistulas are usually complex and often involve more than one organ. The tissues are usually abnormal and failure to heal is a hazard. If at the operation the local conditions are normal, resection of the fistula and restoration of the bowel continuity are acceptable.

This is not the usual finding. In most cases, the tissues are abnormal with edema, fibrosis and loss of all normal planes. The risk of entering an organ is advertently quite high. The risk of failure to heal is higher than normal. Under these circumstances, it is better to construct a good proximal stoma.[55]

Rectovaginal fistulae (RVF):

Rectovaginal fistulae are abnormal, epithelium-lined communications between the rectum and vagina, accounting for approximately 5% of anorectal fistulas.[68]

Etiology:

-Obstetric trauma accounts for the majority 50% to 90% of RVF.
-Rectal, vaginal or other pelvic operations.
- An infectious process such as perianal abscess or Bartholin`s abscess involving rectovaginal septum. Higher RVF may result from diverticular or inflammatory bowel disease.
- Irradiation for carcinoma of the cervix, endometrium or rectum.[69,70,71]

Clinical evaluation:

The most common symptoms are passage of flatus and stool per vagina. There may be a foul smelling vaginal discharge with recurrent or chronic vaginitis. Patients may also be incontinent of feces secondary to associated sphincter injury.

Other symptoms such as diarrhea, bleeding per rectum, mucus discharge, tenesmus, and abdominal pain may be due to the underlying cause of the RVF rather than to the fistula itself.
The RVF may be easily seen and felt on bimanual rectovaginal examination. Multiple perianal fissures or fistulas should suggest the possibility of Crohn`s disease.[68]

Investigations:

Proctoscopy usually suffices in completing the examination when perianal infection or trauma is believed to be the cause. However, if other causes such as inflammatory bowel disease are suspected, colonoscopy or a barium contrast examination is indicated.
Continence should be evaluated both clinically and by laboratory investigations in the form of:

- Endoanal ultrasound.
- Anal manometry.
- Pudendal nerve terminal motor latency.[72,73]

Classification:

Daniels (1949) classified RVF according to location into:

- Low RVF: when the rectal opening is at or just above the dentate line and the vaginal opening is just inside the vaginal fourchette.
- High RVF: when the vaginal opening is behind or near the cervix.
- Middle RVF: those that are located between high and low.

According to the size:

- Small: if < 2.5 cm in diameter.
- Large: if > 2.5 cm in diameter.

Combining the above description with the cause, RVF can be classified as:

- Simple: if RVF are small, low, and due to trauma or infection.
- Complex: if RVF are large, high, and caused by inflammatory bowel disease, irradiation or carcinoma or recurrent after failed repairs.[68]

Management:

Successful treatment entails:
Excision of the fistula and the interposition of healthy tissue between the rectum and vagina.
Any sphincter defect should be repaired to maintain or restore function.
The addition of levatorplasty to sphincter repair improves functional results and also helps reconstruction of perineal body.[74]

Timing of surgery:

Generally, if the surrounding tissues are supple and pliable, no delay is necessary. Any inflammation or infection should be resolved before repair. A waiting period of 3 to 6 months in such cases improves the success rate.
If the patient is severely symptomatic, temporary fecal diversion may be necessary and will also be a useful adjunct for the next repair.

Surgical options:

Surgical options include local repair, transabdominal repair, and tissue transposition procedures.

Local repair:

- Transanal procedures include sliding advancement flaps and layered closure.
- Vaginal procedures include a layered closure or inversion of the fistula.
- Perineal procedures include fistulotomy, perineoproctotomy with layered closure or sphincteroplasty.[75]

Abdominal procedures:

- Low anterior resection.
- Onlay patch anastomosis.
- Abdominal perineal resection and temporary or permanent diversion.

Tissue interposition procedures:

- Pedicled omentum.
- Gracilis muscle.
- Sartorius muscle.
- Gluteus maximus muscle.
- Rectus abdominis muscle.[68]

Fibrin glue:

One novel method described for the treatment of complex RVF is the use of fibrin glue. The fibrous tract is first curetted free of granulation tissue. Fibrinogen and thrombin, in separate syringes, are then injected simultaneously into the fistulous tract with the aid of a Y-connector and plastic catheter. A coagulum quickly forms, plugging the fistulous tract.[76,7]

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