Review Article

Gastrointestinal fistulas: An Update

ABM Moniruddin[1], Salma Chowdhury[2], Md. Sayeed-Bin-Sharif[3], Md. Masudar Rahman[4], M Fardil Hossain Faisal[5], Tanvirul Hasan[6], Md. Rashed Khan[7]

Abstract

A gastrointestinal (GI) fistula is an abnormal connection between gut (GI tract) and an epithelialized surface of skin or another hollow organ or another part of gut. These GI fistulas can cause profound GI bleeding, which may need emergency surgery. Other complications include Malnutrion, Undernutrion, Anaemias, Fluid, and Electrlyte imbalances, Hypovolemic shock, Septic shock, Pyaemic abscesses, Kidney malfunction and failure, Cardiac dysrhythmias, and failure, Hepatitis, Cerebral dysfynction and strokes, DIC etc if neglected, maltreated or untreated. Most GI fistulas occur as a complication of abdominal surgery. However, some fistulas evolve spontaneously and are usually the result of intra-abdominal inflammation or infection. Several classification systems for GI fistulas exist, none of which are used exclusively. The most commonly used classification systems are based on anatomic, physiologic (output volume), and etiologic characteristics. Used in combination, these classifications can help to provide an integrated understanding and optimal management scheme for the fistula. History taking, Physical examination, Endoscopy, Imaging studies and other laboratory tests are variably required for total assessment, evaluation, and concrete diagnosis. Intensive medical, and surgical therapies are now quite dramatically helpful to reduce the morbidity and mortality. This treatise on GI fistula is here to update the information about the latest developments of GI fistula.

Keywords: *Enterocutaneous fistula, Fistula, Surgical site infection.*

Date of received: *11. 11. 2017*

Date of acceptance: *03. 04. 2018*

KYAMC Journal.2018;9(2): 87-94.

Introduction

An enteric or gastrointestinal (GI) fistula is an abnormal anatomic connection between a part (or multiple parts) of the GI lumen and the epithelialised lumen of an organ like bladder, blood vessel, urethra, uterus, vagina or another part of GI tract etc or epithelialized surface like skin. Intestinal fistula includes many clinical entities.[1,2] Because fistulas are widely defined, they are generally classified by anatomic, physiologic, and etiologic methods, all of which have treatment implications.[3] Approximately 80-90% of all small intestinal fistulas develop from operative intervention. Approximately 50% of small intestinal fistulas develop from inadvertent enterotomies in patients in whom no intestinal anastomoses were performed. The remaining 50% are related to complete or partial disruption of intestinal anastomotic suture lines.[4,5] Approximately 10-20% of all small-bowel fistulas arise spontaneously in association with inflammatory processes, malignancy, radiation therapy, and infectious diseases.[6] Of these 10-20%, Crohn's disease accounts for 5-50%, cancer for 2-15%, peptic ulcer disease for 3-5%, pancreatitis for 3-10%, radiation therapy for 2-5%, and infections for 2-5%.[6,7] Surgical procedures that are commonly associated with post-operative fistula formation include re-operative procedures that require extensive adhesionolysis, trauma inflicted during non-cancer surgeries, mesh repair of ventral hernias, laparoscopic procedures etc.[8] Crohn's disease is the leading cause of spontaneous small intestinal fistulas, accounting for more than 50% of cases. Small intestinal fistulas develop in 20-40% of all patients with Crohn's enteritis; half of these are enterocutaneous, and the remainder are internal fistulas to other abdominal viscera or organs.[7]

1. Professor & HOD of Surgery, Khwaja Yunus Ali Medical College & Hospital, Enayepur, Sirajgonj, Bangladesh.
2. Associate Professor, Department of Obsetrics & Gynaecology, Dhaka Medical College Hospital, Dhaka, Bangladesh.
3. Assistant Professor, Department of Surgery, Khwaja Yunus Ali Medical College & Hospital, Enayepur, Sirajgonj, Bangladesh.
4. Assistant Professor, Department of Surgery, Khwaja Yunus Ali Medical College & Hospital, Enayepur, Sirajgonj, Bangladesh.
5. Consultant, Department of Surgery, Khwaja Yunus Ali Medical College & Hospital, Enayepur, Sirajgonj, Bangladesh.
6. Assistant Surgeon, Department of Surgery, Sher-e-Bangla Medical College, Barisal, Bangladesh.
7. Registrar, Department of Surgery, Khwaja Yunus Ali Medical College & Hospital, Enayepur, Sirajgonj, Bangladesh.

Correspondence: ABM Moniruddin, Professor & HOD of Surgery, Khwaja Yunus Ali Medical College & Hospital, Enayepur, Sirajgonj. E-mail: abmmu@yahoo.com; Mobile: 01795078217.

Historical aspects

In 450 BC, the ancient Indian surgeon Sushruta[8,9] wrote the Sushruta Samhita, which described major abdominal operative procedures, including resection and reanastomosis of intestinal segments for repair of external intestinal perforations or enterocutaneous fistulas. In 350 BC, the ancient Greek surgeon Praxagoras[9] created an enterocutaneous fistula to relieve intestinal obstruction. This technique was referenced in Western medical literature in 1899 by Werth, who advocated creation of an enterostomy to treat intestinal obstruction. In 1906, at a surgical society meeting in Chicago, John Finney[10] mentioned enterostomy as a surgical option to treat severe postoperative ileus recalcitrant to other management. In 1597, Fabricius Hildanus,[11] a German surgeon, reported a patient with a Richter hernia who developed intestinal gangrene and formed an enterocutaneous fistula. Treatment should be individualized on the basis of the patient's overall medical condition and radiologic and intraoperative findings.[12]

Epidemiology

The prevalence of fistulas secondary to Crohn's disease may be less prevalent in Africa primarily because the disease is less prevalent in that population. However, the prevalence of obstetric fistulas is higher in developing countries because of obstructed labor and lack of prompt access to emergency obstetric care. Accurate prevalence rates of obstetric fistulas are unavailable, because of inaccurate reporting. Racial differences in patients with fistulas generally parallel those of the underlying disease or condition that predisposed persons in a specific racial population to developing fistulas. For example, Crohn disease fistulae are is more common in whites.[13]

Aetiology and pathogenesis

The common aetiological pathogenesis of intestinal fistula acquisition are mentioned in brief as follows: 1. Congenital gastrintesinal fistulas develop owing to failure of closure and obliteration of developmental communicating channels like persistent vitello-intestinal duct discharging at the umbilicus, congenital rectourethral or rectovaginal fistulas, congenital trachea-esophageal fistulas etc.[3] 2. Operative like Inadvertent enterotomies4 and leakage from intestinal anastomoses result in leakage of intestinal contents with abscess formation. The abscess erodes through the abdominal wall, commonly at the surgical incision site or drainage site resulting in an enterocutaneous fistula.[14] 3. Intestinal anastomoses are susceptible to partial or complete disruption because of impaired blood supply, systemic hypotension, anastomotic suture line tension, perianastomotic infection, and diseased bowel segment.[15] 4. Exposure of the bowel to prosthetic mesh or a large abdominal defect can lead to wall erosion, resulting in enterocutaneous fistula. Intraperitoneal drainage tubes can erode into the intestinal lumen, leading to enterocutaneous fistula formation.[16] 5. Penetration & erosion of the intestinal wall from a foreign body (eg, an ingested metallic object or a fish bone) can lead to enteroenteric fistula formation.[17] 6. Penetrating trauma (ie, stab or gunshot wounds) rarely results in enterocutaneous or enteroenteric or nephroenteric fistula formation.[18] 7. Intestinal infections like amebiasis, actinomycosis, tuberculosis, Salmonella, coccidiomycosis, and cryptosporidiosis can all result in periluminal abscesses and fistulas.[17] 8. A solid-organ abscess, like an amebic hepatic abscess, can lead to a bilio-enteric or broncho-biliary fistula or rupture of a perinephric abscess can lead to nephroenteric fistula formation. Diverticular and appendiceal abscesses can also lead to enteroenteric or enterocutaneous fistula formation. Appendicocutaneous fistulas may occur after percutaneous drainage of an appendiceal abscess specially in presence of Crohn's enteritis.[19] 9. Crohn's enteritis can progress to internal & external fistulas like enteroenteric, enterovesical, enterovaginal, and perineal.[12] 10. Radiation enteritis can lead to enteroenteric fistula formation. Similarly, degeneration of malignant tumors of the intestine or solid abdominal structures can lead to erosion into adjacent bowel loops, leading to fistulas.[20]

Factors precipitating fistulation

1. Subjective (Patient) factors- Anaemias, Malnutritin, Undernutrition, Sepsis, Hypotension, Hypothermia, Hypoxia including respiratory diseases, emergency surgeries, adhesions, Specific diseases like tuberculosis, Crohn's diseases, malignancy, Immunosuppression, Immunodeficiency, Immunocompromisation etc.[21] 2. Technical problems- Improper mobilization, dissection, cauterization, bowel preparation, Insecured anastomosis, Tension at anastomosis, Ischaemic cut edges etc.[21]

Classifications

A. Anatomical classification- 1. External [Enterocutaneous (Postoperative and Spontaneous)][4] 2. Internal, e.g., Colovesical, Rectovaginal etc. B. Aetiological and Developmental classification- 1. Congenital, e.g., Tracheo-esophageal,[22] 2. Acquired, e.g., Rectovesical fistula following obstructed labour. (a) Anastomotic failure as following anastomotic surgery. (b) Traumatic as following blunt external trauma or inadvertent operative trauma. (c) Bowel pathology like Crohn's enteriris, Ca colon etc, (d) Extra-intestinal pathology like Ca bldder, Ca Cervix etc. C. Organ specific classification- 1. Oropharyngeal, 2. Oesopharyngeal, 3. Gastric, Doudenal, 4. Small bowel, 5. Colonic, 6. Rectal etc.[23] D. Depending on daily output24- 1. High output fistula: >500 ml/day, 2. Moderate output fistula: 200 to <500 ml/day, 3. Low output fistula: <200 ml/day. E. Depending on type of fistula opening- 1. End fistula & 2. Lateral fistula.[25] F. Depending on number of tracks or associated pathologies- 1. Single, 2. Complicated (multiple tracks, or track with an abscess, connecting multiple viscera etc[25]. G. Depending on stoma categories- 1. Category 1: A single orifice fistula through an intact abdominal wall or healed scar with normal adjacent skin,[25] 2. Category 2: Single or multiple fistulas passing through abdominal wall close to a bony part or umbilicus or surgical scar,[26] 3. Category 3: Fistula through a small dehiscence in the main incision wound,[27] 4. Category 4: Fistula through a large dehiscence in the main incision wound or dehiscence at the bottom of wound.[23] H. Depending on prognosis- 1. Favourable fistulas (Sites: oropharyngeal, oesophageal, duodenal stump, pancreaticobiliary, jejuna, colonic. Causes: Postoperative, appendicitis, diverticulitis. Low output fistula with Absent sepsis, S transferrin >200 mg/dl. Healthy adjacent tissues with intestinal continuity and without distal obstruction.

2. Unavourable fistulas (Sites: Gastric, Lateral duodenal, Ileal. Causes: Malignancy, IBD (Inflammatory Bowel Disease). High output fistula, poor nutrition, sepsis, S transferrin <200 mg/dl. Diseased adjacent bowel/tissues, with distal obstruction, Large abscess, Complete bowel disruption, Radiation, Immunosuppression, Immunodeficient, Immunocompromised. Fistula track <1 cm long and bowel wall defect >2cm square, Track epthelialisation, Foreign body, thick fibrous wall, Tuberculosis etc.[25]

Pathophysiology

The intestinal bacterial flora leads to contamination of nonintestinal tissue and evolution of sepsis. The intestinal fluid can be damaging or corrosive to the nonintestinal tissue, leading to breakdown, erosions, and loss of normal organ or organ system function. Physiologically a fistula is interpreted by its output in a 24-hour period. Aetiological iexplanations (eg, malignancy, inflammatory bowel disease, or radiation) define the associated disease leading to the development of the fistula. Each type of classification system carries specific involvements regarding the likelihood of spontaneous closure, prognosis, operative timing, and nonoperative treatment planning.[26]

Clinical features

The predominant signs and symptoms are those of infection from intestinal bacterial contamination, depending on the organs involved. Enterocutaneous fistula: Excessive drainage of intestinal contents with or without bile staining, purulent fluid, gas bubbles, surrounding erythematous or excoriated or indurated or fluctuant skin, fever, tachycardia, chills[27]. Enteroenteric fistula: Diarrhea, abdominal pain, weight loss, fever, abdominal tenderness, a palpable abdominal mass may be present.[27] Enterovesical fistula: Bladder irritability, dysuria, pyuria, fecaluria, and pneumaturia. Fulminant urosepsis may develop, especially in immunocompromised or immunosuppressant or immunodeficient patients.[28] Nephroenteric fistulas: Features of UTI (urinary tract infection), flank pain, tenderness, and a mass, fecaluria, pneumaturia, fever, chills, and fulminant sepsis, watery diarrhea, severe dehydration, uremia, and acidosis, Perinephric abscesses etc.[28] Enterovaginal fistulas: Purulent or feculent vaginal discharge, Sepsis, abdominal pain, fever, and chills, Features of UTI etc.[29] Aortoenteric fistula: Gastrointestinal (GI) bleeding in the form of hematemesis, hematochezia, melena etc. Patients with a paraprosthetic-enteric fistula may have a perigraft abscess or an aneurysm that communicates with the intestinal lumen. Sepsis and abdominal pain, chronic anemia etc mau be variably seen.[29]

Complications

Bleeding, Malnutrion, Undernutrion, Anaemias, Fluid and Electrlyte imbalances, Hypovolemic shock, Septic shock, Pyaemic abscesses, Kidney malfunctions and failure, Cardiac dysrhythmias and failure, Hepatitis, Cerebral dysfynction and strokes, DIC etc if neglected, maltreated or untreated.[30] Inadvertent enterotomies and excessive blood loss during adhesionolysis of fistula surgeries, Sepsis leading to death because of anastomotic breakdown or intraperitoneal contamination or manipulation of infected tissue during operative procedures, Abdominal abscesses, Blind loop and Short-bowel syndromes after surgeries, Recurrences etc.[29]

Differential Diagnoses

Abdominal Abscesses, Aortic Aneurysms, Gynecologic and Oncological Surgical wounds, Abdominal Trauma, Aortitis, Appendicitis, Colon Cancer, Colonic Obstruction, Urinary Tract Infection (UTI) and Cystitis, Diverticulitis, Inflammatory Bowel Diseases, Malabsorptions, Peptic Ulcer Diseases, Diverticulitis, Vascular Surgery for Arteriovenous Malformations, Wound Infections etc.[31]

Diagnostic Procedures

History taking & physical examination followed by laboratory aids that may include the following:[7,30] 1. Upper GI endoscopy, 2. Cystoscopy, 3. Laboratory Investigations: complete blood count (CBC), Serum electrolytes, B. Ures or blood urea nitrogen (BUN), Serum Creatinine, Serum albumin, Serum transferrin, Serum prealbumin or retinol-binding protein, Blood culture, Urine analysis and culture etc., 4. Imaging Studies: CECT scan, Fistulography, Ultrasonogram etc., 5. Histopathology, 6. Other Investgations: Oral charcoal or metylene blue test etc.

Treatment

Medical/Conservative Therapy:[26] Initial treatment is conservative, including resuscitation, sepsis control, local management of fistula output, nutritional support, pharmacotherapy and radiologic investigations. The final treatment, if necessary, is restorative surgery. Resuscitation: Careful replacement of the losses of fluid and electrolytes is essential and is often accompanied by CVP (central venous pressure) monitoring. Continued monitoring of ongoing losses and replenishment is essential. Patients with high output and proximal fistulas develop significant metabolic acidosis, which may need intravenous sodium bicarbonate administration. Control of sepsis: Tachycardia, persistent fever, and leukocytosis indicate active infection. Treatment with broad-spectrum antibiotics and local drainage of abscesses (if present) may have to be done. Most deep or intraperitoneal collections are best treated by imaging guided drainage. Open surgical drainage may have to be done if the abscess is not accessible. The fistula may need to be completely exteriorized to the skin level to prevent further intra-abdominal fluid collection. Local management of fistula: Fistula output may be reduced by gastro-enteric drainage by Nasogastric or nasojejunal tubes proximal to the fistula, keeping the patient on NPO. Adjacent or escaping fluid needs placement of a collecting bag, which can also be attached to a low continuous suction. Stomahesive (a skin barrier material that contains a mixture of pectin, gelatin, and carboxymethy-lcellulose in wafer form) is applied to eroded skin to protect and allowed to heal. Total parenteral nutrition (TPN) may need to be initiated. Thus enterocutaneous fistula output may be controlled & intraperitoneal accumulation of intestinal contents is prevented, protecting the skin from the corrosive effects. To control of enterocutaneous fistula drainage, various modifications of drainage tubes within the fistula tract and collecting bags are used. Pharmacotherapy:[30] Histamine 2-receptor antagonists (eg, famotidine), somatostatin analogue (eg, octreotide 100-200 microgram, s.c.,

8 h), if Crohn's enteritis cyclosporine, azathioprine and 6-mercaptopurine (6-MP), Infliximab [a chimeric monoclonal antibody to tumor necrosis factor alpha (TNF- α)] can decrease the fistula output. **Surgical treatment:** Indications for surgery: Early surgery is required for:[26] 1. Sepsis or abscess formation not amenable to percutaneous drainage; 2. Complete distal intestinal obstruction; 3. Uncontrolled bleeding from fistula; 4. Removal of mesh or other foreign bodies; 5. Inability to control the fistula without surgical drainage; 6. Aortoenteric fistulas (definitively managed by means of emergency surgery as soon as the diagnosis is made). Delayed surgery is indicated if not healed after several (typically 4-8) weeks of comprehensive conservative treatment. Specific indications include: 1. Continued high output from fistula after patient has been given nothing by mouth and started on parenteral nutrition; 2. Continued signs of infection after institution of adequate antibiotic therapy and drainage of associated abscesses; 3. Uncontrolled bleeding. MIS: Laparoscopic resection of internal fistulas as well as enterocutaneous fistulas is done. Fibrin glue applications, as well as porcine and bovine tissue plugs, have been used to successfully close enterocutaneous fistulas. **Basic principles of surgical treatment:**[25] The basic surgical principles for treatment of all intestinal fistulas include the following: 1. Resection of the intestinal segment, fistula tract, and the adjacent part of the involved structure. 2. In absence of infection or inflammation, primary anastomosis of the divided intestinal segments is done to restore the GI continuity and to regain and maintain the function. 3. In presence of infection or inflammation, the divided intestinal segments are exteriorized and the surgical procedure is modulated to allow replacement or maximal preservation of function. 4. A staged procedure is performed after the infection and inflammation subsides to re-establish GI continuity and reconstruction of the affected segments. **Choice of surgical procedure for specific fistula types:**[26] **Enterocutaneous fistula:** Resection of the involved intestinal segment with primary end-to-end anastomosis is the procedure of choice and allows successful healing in most patients. Exteriorization of the proximal and distal ends of the intestine is performed in presence of sepsis whenh primary anastomosis is inappropriate. An everted ostomy is created from the proximal end to allow successful postoperative fitting of an appliance. A bypass procedure is done when dense adhesions are encountered within the pelvis that complicates extensive lysis of adhesions. The aim is to defunctionalize the intestinal segment containing the fistula. Later on the intestinal continuity is restored after removing the segment containing the fistula. Sometimes it needs bypassing of densely adherent fistulous loops creating an anastomosis between the divided afferent limb and the transverse colon. If it is hard to mobilize the distal intestinal segment adequately, sometimes the proximal segment is mobilized and anastomosed to the transverse colon, while the distal segment is closed and left in place or exteriorized as a mucous fistula. If intestinal continuity cannot be restored, the ends are exteriorized, and a staged procedure is performed with an end-to-end anastomosis. Though this is not always possible, the staged procedure may be done when the fistula segment is removed later. Direct suture closure of the fistula is rarely successful and is used only as a last resort in patients with dense abdominal adhesions that preclude enteroclysis or in debilitated patients who cannot tolerate prolonged anesthesia. GI fistulas associated with large abdominal defects are often challenging problems and are associated with a high mortality. Multiple staged procedures are necessary, with the aim of reconstructing the abdominal wall while controlling the fistula. The fistula may be controlled with a Malecot or soft-sump catheter intubation, while the adjacent abdominal wall defect is covered with split-thickness skin grafts or musculocutaneous flaps. **Enteroenteric fistula:** The ideal procedure for surgical treatment of enteroenteric fistulas is en-bloc resection of the involved intestinal segment in continuity with the fistula tract. In the absence of infection or remarkable inflammation, a primary anastomosis of healthy bowel ends can be done. In the presence of inflammation or infection, a proximal diversion procedure with wide drainage of the abscess cavity is performed. This is followed in 4-6 weeks with a delayed resection of the involved intestine and fistula. All attempts are made to conserve bowel length in both primary and staged procedures. Resection should be limited to the area of intestine involved in fistula formation. Extensive resection is not advantageous and only increases the risks of subsequent short-bowel and malabsorption syndromes. In case of Crohn disease, the patient may need additional intestinal resections. **Enterovesical fistula:** Resection of the diseased intestine and the involved area of bladder wall and primary anastomosis of the bowel are performed, and the bladder wall is closed in layers. The areas of repair are separated with interposition of omental tissue, if possible. The presence of inflammation makes healing of an anastomosis or repair difficult and unlikely. The safer procedure in these instances is transection of the intestinal segment proximal and distal to the fistula, leaving the fistula tract in place. Both ends of the intestine are exteriorized. This allows the urinary tract to remain free of contamination from intestinal contents. The patient is treated with appropriate antibiotics. Once infection and inflammation are resolved, a delayed surgical procedure can be performed to resect the fistula tract and intestinal segment with primary repair of the bladder wall. **Nephroenteric fistula:** Medical treatment alone is rarely successful here. The surgical procedure of choice is either total or partial nephrectomy, with en-bloc resection of the fistula tract and the involved intestinal segment. The ends of the intestines are anastomosed primarily. Partial nephrectomy is appropriate in patients whose renal function is not severely impaired (as is mostly observed in nephroenteric fistulas of traumatic origin). The presence of a contralateral functioning kidney is verified prior to a total nephrectomy. In the presence of severe inflammation or infection, the intestine is not anastomosed primarily. The segments are exteriorized to skin level, and a delayed anastomosis is performed after inflammation and infection have subsided. **Enterovaginal fistula:** Surgery is reserved for patients who do not respond to conservative treatment with antibiotics and drainage of associated abscesses. An en-bloc resection of the involved intestinal segment with fistula and affected vaginal wall is performed. The intestinal ends are anastomosed primarily; the vaginal defect may be closed primarily. Resection of a cuff of vaginal tissue along with the fistula and involved intestine is the preferred surgical approach.

A primary intestinal anastomosis should be performed if the surrounding inflammation permits. The vaginal defect may be left open to allow postoperative external drainage of the pelvis. **Enterouterine, enterocervical, and enterofallopian fistulas:** Appropriate treatment of the underlying disease with a total hysterectomy is usually indicated. The resected intestinal ends are anastomosed primarily. **Aortoenteric fistula:** Emergency surgical intervention is required for aortoenteric fistula. The aortic prosthetic graft is removed, and an extra-anatomic bypass procedure is performed. The intestinal defect is debrided and closed primarily. The presence of extensive inflammatory or devitalized tissue may necessitate intestinal resection and an end-to-end anastomosis. It is possible to have successful resection of the aortoenteric fistula followed with in-situ replacement of the infected prosthesis with a new prosthetic graft or cryopreserved aortic homograft. This procedure is associated with the risk of recurrent fatal aortoenteric fistula. **Procedural details:** Preoperative concerns.[21] If the patient attains good nutritional status, remains free from sepsis, and has fistula output that progressively decreases, conservative treatment should be continued. More than 90% of all fistulas close spontaneously within 4-6 weeks; fewer than 10% close after 2 months, and none spontaneously close after 3 months. The acronym FRIENDS is commonly used to predict the likelihood of fistula closure. FRIENDS stands for the presence of Foreign body, Radiated bowel, Inflammation (commonly owing to Crohn's disease), /Infection, Epithelialization of the fistula tract, Neoplasm, Distal intestinal obstruction, and pharmacologically administered Steroids. These indicate a low likelihood of fistula closure. Identification and possible correction of some or all of these factors increase the chances of fistula closure. Delaying surgery permits peritoneal reaction and inflammation to subside, making a definitive surgical procedure easier and safer. Prior to surgical intervention for fistulas, control of infection and optimization of nutritional status are important. Surgical intervention is most commonly undertaken for persistent fistula drainage despite adequate conservative treatment. The need for emergency or urgent surgical intervention for intestinal fistulas is uncommon. An undrained intraperitoneal abscess not amenable to drainage guided by computed tomography (CT) or ultrasonography is most likely to necessitate emergency intervention. Other indications include the presence of complete distal intestinal obstruction, uncontrolled fistula bleeding, the presence of mesh or other foreign bodies, and an inability to control the fistula without surgical drainage. Surgical planning for fistula repair is individualized according to the patient's overall medical status, radiologic findings, and intraoperative findings. Prolonged surgery may be anticipated with significant fluid shifts. Appropriate preoperative planning includes the following: To ensure that the patient is euvolemic before the procedure; To provide blood transfusions as required; To administer appropriate antibiotics; To place a central venous catheter to determine intravascular volume status and thereby to direct perioperative management; To place a Foley catheter to monitor urine output. **Intraoperative concerns:**[21] The surgical approach to the peritoneal cavity is through an incision that is located away from the areas of potential infection, inflammation, and adhesions. If a previous midline incision is present, the abdomen can be entered in the midline above or below the incision. This minimizes the chances of encountering adhesions to the abdominal wall and inadvertent enterotomies. A transverse incision located away from previous incisions is also a good option and allows peritoneal entry in an area free of adhesions. Adhesions are lysed by starting from the area with the least dense adhesions and progressively approaching the more dense areas of adhesions and inflammation. Extensive lysis of adhesions is performed to free up the bowel from the ligament of Treitz to the rectum. This allows a complete inspection to exclude the presence of inter-loop abscesses and areas of obstruction; which is especially important in patients with complex fistulas as well as clinical and radiologic signs of obstruction. Extensive adhesiolysis may not be safe or feasible in the presence of dense adhesions. In these instances, dissection is limited to the areas that correlate to the areas of fistula, abscesses, or obstruction as identified on preoperative radiologic examinations. Certain maneuvers are helpful in facilitating lysis of adhesions. Sterile water-soaked or saline-soaked laparotomy pads are applied to the areas of adhesions. This creates local edema that allows easier dissection. Lysis is best performed with careful sharp dissection using scalpel or Metzenbaum scissors. Blunt finger dissection had been associated with a higher incidence of enterotomies. The underlying bowel can be protected during the dissection by placing a hand behind the adhesions. Large defects of the bowel wall can be repaired with a serosal patch, typically using the proximal jejunum. Enterotomies are repaired by using a two-layer closure, ensuring that no narrowing of the bowel lumen occurs. Serosal tears may be repaired with Lembert sutures. Prior to abdominal closure, available omentum is placed between the bowel and the abdominal wall or the areas of resected and repaired adjacent structures involved in the fistula formation. Patients with large open abdominal walls or defects may be candidates for an abdominal closure using absorbable mesh. In a previously infected field, mesh carries the risk of recurrent infections and fistulas. Fascial closure through separating the components of the rectus abdominis muscle-fascial complex can be used to achieve abdominal closure. **Postoperative care:**[21] Continued nutritional support is essential in the postoperative course. A feeding jejunostomy or gastrostomy tube may be placed if prolonged nutritional support is required. **Management may be summaried in the following phases:**[23] Phase 1-(a). Resuscitation & restoration of blood volume with crytalloids, colloids, blood transfusion to have Hct (Haematocrit) of 30 p.c., maintenance of S Albumin 30 gm/L. (b). Sepsis control with antibiosis, aseptic care, percutaneous or open drainage etc. (c). Skin care to prevet/treat excoriation. (d). Reducing fistulous output by PPIs (Proton Pump Inhibitors), Antihistamines, Sucralfate, Octreotide, Infiximab (if Crohn's fistula) etc. (e). Nutritional support and supplement by adequate calorie-rich (30 Kcalorie/kg/d) and protein (1.5 g/kg/d) diet; TPN (Total Parenteral Nutrition) is followed by enteral (oral or through gastrostomy or jejunustomy) in absence of distal obstruction to reduce sepsis, improve bowel activity and healing of anastomosis and to prevent TPN related hazards etc. Phase 2- By 7 to 10 days, Investigations to assess and evaluate and to detect the cause etc. are to be done.

Fistulogram, CT fistulogram can detect site, number, length, bowel status, distal obstruction, abscess cavity etc. S electrolytes, S albumin, Hct and hepatic, renal, respiratory and cardiac statuses are to be assessed. Phase 3- Definitve procedure for fistula is done after at least six weeks to reduce mortality, morbidity and recurrence from obliterative peritonitis through a new distant often transverse incision. For bowel refunctionalisation, the entire bowel from the ligament of Treitz is freed clearing adhesions, obstructions, sepsis and abscesses by sharp dissection using scissors if needed, avoiding bowel injuries repairing transversely by interrupted 3/0 polydioxanone or similar sutures. Resection of the track along with the fistulous segment of bowel and end to end two layered 3/0 polydioxanone anastomosis are deemed to be an ideal procedure. If resection of the fistulous segment isn't possible, the fistula area bypass, Roux-en-Y drainage, serosal patch technique etc are followed. Duodenal fistula is better managed by gastrojejunostomy and vagotomy without intervening the fistula. Adequate irrigation of the abdominal cavity with saline and antibiotics, omental flap around the anastomosis, various solutions to prevent re-adhesion development are in use. Additional supportive jejunostomy for enteral feeding may be required. By primary closure or by myocutaneous flap, abdomen should be closed. Mesh is avoided to prevent recurrence. Phase 4- During recovery and healing, optimum care should be given along with supplementation of nutrition, protein, vitamins, essential elements and physical plus psychological therapy. Special measures for enterocutanous fistulas: Absolute sepsis control, prevention and treatment of abdomen compartment syndrome are essential measures. Equally important are assessing the fistula type and anatomy, nutrition, skin care, fluid and electrolyte balance. Fistula output more than 1000 ml needs TPN and is most likely resistant to spontaneous closure. Fistula output less than 500 ml is more likely will close spontaneously. Here fluid should be restricted to 1500 ml in 24 hour with 1000 ml as hypertonic content. PPI decreases gastric secretion. Loperamide 4 mg 6h and Codeine phosphate 60 mg 6h also reduce the output. Octreotide 200 microgram 8h s.c. for 48h decreases pancreatic and small intestinal secretion. Aggressive monitoring by ensuring urine output (>1 L/d), U Na+ >20 mmol/L, S Mg ++ >0.7 mmol/L. Adequate nutrition and avoiding weight loss plus assessing liver and kidney functions and Hct are of utmost importance. For unfavourable fistula, timing for surgery must be judicial (usually after twelve weeks). Resection of the fistula track with adjacent bowel and anastomosis or creation of such stoma as ileostomy, gastrostomy, colostomy as justified are the most commonly the logical procedures. The entire small bowel when involved needs to be mobilized after adhesionolysis. Reconstruction of the abdominal wall is done by primary closure or by compartment separation technique (Ramirez) with use of such biological mesh as decellularised collagen mesh as inlay or onlay. Initial vacuum-assisted dressings, packing are another options. (Later on restoration of the normal continuity is done closing the -ostomy in time).

Prognosis

In addition to physical discomfort and pain, the stigmas of malodorous fistula drainage, malnutrition, and emotional distress cause significant psychological consequences. Patients with postoperative fistulas have the added distress of lengthy hospital stays, associated morbidity, a delay in returning to work, and restricted social activities. During the early 20th century, the mortality associated with enterocutaneous fistulas was was as high as 70-100% because of sepsis, severe electrolyte and fluid imbalances and malnourishment. With the advent of parenteral nutritional support and aggressive treatment of sepsis, the mortality and morbidity associated with fistulas decreased to 30-50%. In the current treatment of intestinal fistulas, a multidisciplinary approach has helped decrease the mortality to 15-37%. The spontaneous fistula closure rate is reported as 23-80%. The wide range reflects the multiple factors that affect fistula closure. The typical spontaneous closure rate is 30-35%, achieved through ensuring nutritional support and infection control. Ancillary surgical or interventional procedures in the form of drainage of abscess cavities are required in almost 20-30% of all fistulas that spontaneously close.[22] Of all fistulas that are likely to close spontaneously, 85-90% close within 4-6 weeks after the initiation of conservative management (ie, nutritional support, treatment of sepsis, control of fistula output). After 3 months of conservative treatment, fistulas that have not healed spontaneously will not heal. Most fistulas should be treated conservatively for 4-6 weeks. Patients with fistulas that show signs of improvement during this period may continue to be treated conservatively with the expectation of closure. Conversely, patients who show no signs of improvement should undergo surgical treatment. In patients who undergo definitive surgical closure for treatment of fistulas, the fistula recurrence rate is reported to be 13-34%. The likelihood of spontaneous fistula closure in a patient with infectious complications is 16 times lower than that in a patient without associated infectious complications. The chances of spontaneous closure are three times higher in patients with low-output fistulas than in those with high-output fistulas. Reports in the literature suggest mortality figures of 54-32% for patients with high-output fistulas and 26-6% for those with low-output fistulas. Jejunoileal enterocutaneous fistulas and lateral duodenal fistulas are both high-output fistulas with an associated spontaneous closure rate of only 18-20%; both are more likely to require surgical intervention for closure. A higher mortality, mostly secondary to sepsis, is reported in patients who receive parenteral nutrition. The rate also reflects that patients with high-output fistulas requiring parenteral nutrition are the most critically ill. Enteral nutrition is more feasible in patients with low-output fistulas and is associated with a lower mortality. Serum albumin level less than 2.5 mg/dL carries a mortality of 64% and a spontaneous closure rate of 23%. Serum transferrin levels of greater than 200 mg/dL are also reported to be associated with a higher rate of fistula closure and survival. Spontaneous closure rate in elderly patients is lower because of a higher mortality from associated co-morbid conditions and poor nutritional and physiologic reserves. Recurrence of enterocutanous fistula, on an average, after proper therapy is about 15-20 p.c. Disruption, distal obstruction, specific causes, malnutrion, old age, immunosuppression are variable causes of recurrence.[31]

Conclusion

Regardless of their cause, fistulas have a tremendous impact on patients, society and state. Increased morbidity and mortality rates, greater health care costs for diagnosis and treatment, prolonged hospital stays, and delayed return to work are just a few direct consequences of this condition. Fistulas were formerly associated with considerable mortality rates. In the decades following the 1960s, however, the introduction of intensive care units (ICUs) and parenteral nutrition dramatically lowered the mortality rate to approximately 20%; however, prolonged hospital stays and the high cost of medical and surgical care remained unchanged. In addition, the frequency of fistula formation has not decreased, because of advanced and complicated disease, complex surgical techniques, and an aging population.

Recommendation

Every developing country or state, region and society should have national and rational policies to prevent, manage and treat GI fistulas in collaboration with the developed countries assuming the whole globe as a single unit and heart of humanity.

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