Complications and Management of Small Intestinal Fistula

Essay

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INTRODUCTION

Intestinal fistula is an abnormal passage between the intestine and another segment of the intestine or other organs. The causes of intestinal fistula are either congenital or acquired. The acquired causes may be due to inflammation, iatrogenic, malignancy, radiation, aortic aneurysm, trauma, and foreign body.

The diagnosis of developing fistula generally depends on the history of the disease and physical examination which may be confirmed by investigations such as endoscopy, fistulography, Ultrasonography, CT, and MRI.

The complications of fistula are essentially due to fluid and electrolytes imbalance. Other complications include skin irritation, intestinal obstruction, wound infection, bleeding, and psychological trauma; these complications should be avoided and treated properly.

The main goal of fistula treatment is to achieve closure in the shortest possible time. This can generally be achieved by reducing the losses of fluids and nutrients.

Although progress of fistula is recognized when it occurs, the duration of nutritional support and supportive medical treatment varies from patient to patient. Each patient should be individualized and the decision to operate should be made after careful assessment of the patient's hospital course and in the context of the patient's disease process and current problem. It is essential,

however, that the site and nature of the fistula be defined early and that any conditions likely to prevent spontaneous closure be identified.

However, failed conservative management can be difficult to define and how to progress should depend on the following considerations: Was the conservative treatment optimal? Is there a clear anatomical reason to prevent healing? Has nutritional status been effectively addressed? Has sepsis been controlled; and is the patient fit for surgery?

Generally, surgery is indicated in patients with fistulae that fail to close spontaneously after a 30–60 day period of sepsis free parenteral nutrition, although in some cases surgery can be avoided for at least three months. Endoscopic occlusion of gastrointestinal fistulae can be successfully achieved in a high percentage of patients. Fistuloscopy is a new technique which has been devised, using a flexible endoscope advanced percutaneously along the fistula tract to seal these gastrointestinal fistulae.

There is great variability in the mortality rates of gastrointestinal fistula patients due to the very heterogeneous nature of patients and their fistulae. Whereas some patients are well nourished and have a well-drained low-output fistula, others are in poor general and nutritional conditions, may be septic and dehydrated, and may present with complex abdominal wall defects or macerated skin. Comparison of mortality rates of patients with gastrointestinal fistulae is difficult because many variables influence the results, including the organ of fistula origin, fistula output, inclusion of internal or only external fistulae, the percentage and degree of malnutrition of the population studied, the presence of sepsis, the diagnosis of inflammatory bowel disease or cancer, and the presence of complex abdominal wall defects. The presenting clinical picture influences the surgeon's decision whether to operate the patient early to ensure adequate

drainage of the fistula or to perform an ancillary procedure such as a feeding jejunostomy or diverting colostomy. Conversely, the surgeon may decide to wait, with the expectation that the fistula will eventually close spontaneously with supportive treatment. Thus, an understanding of the factors that influence outcome concerning the likelihood of spontaneous fistula closure or the need for surgical intervention is of great value to the surgeon in the decision-making process.

Aim of the work:

The aim of this essay is to study the best ways of diagnosis of small intestinal fistula and morbid complications and its management either by conservative or surgical maneuvers.

CHAPTER I

ETIOLOGY AND PATHOPHYSIOLOGY OF INTESTINAL FISTULA

Intestinal fistula is an abnormal anatomical passage between the intestine and another segment of the intestine or other organs. External intestinal fistula is connected to the skin (Enterocutaneous fistula).Internal intestinal fistula can be connected to a number of organs, such as stomach (gastrocolic fistula), the biliary tract (cholecystoduodenal fistula), or the urinary bladder (colovesical fistula) **(Slade and Scott, 2005).**

Gastrointestinal fistulae are generally named according to their participating anatomic components, and virtually every imaginable combination has been reported in the medical literature. Rather than recite all possible permutations, because the terminology can be somewhat variable, we have attempted to use fistula names that prevail in the literature, regardless of underlying etiology. To begin, it is useful to separate congenital and acquired causes (table 1), since their clinical settings and implications obviously differ greatly **(Perry et al., 2002).**

Table (1): Classification of small intestinal fistula

- Congenital
- Acquired
  - Internal
    - Intestinal (Gut-to-Gut)
    - Extra intestinal
      - Genitourinary
      - Biliary
      - Vascular
      - Respiratory
      - Other
  - External
    - High-output
    - Low-output
  - Complex (Internal and external)

(Perry et al 2002)

I-Congenital fistulae:

Developmental errors may result in both external and internal fistulae. Despite the relatively common occurrence of Meckel's diverticulum, patent Vitello-intestinal duct with fistula formation is rare, occurring only in every 1500 births. Although it usually presents as a faecal discharge at the time of umbilical cord sloughs, it may become unapparent until adult life, when its appearance is precipitated by development of distal obstruction **(Williams et al., 1990).**

II-Acquired fistulae:

The underlying causes of acquired gastrointestinal fistulae are diverse and can include virtually any process resulting in bowel perforation from within or bowel penetration from an extra intestinal process .The majority of external (cutaneous) fistulae represent a complication of recent abdominal surgery. The leading causes of internal fistulae in the industrialized world are Crohn's disease, diverticulitis, malignancy, or complications of treatment of these entities (table 2). Not surprisingly, many cases are the result of multiple contributing factors; common examples include cancer patients who have undergone radiation therapy and patients with Crohn's disease who have undergone prior bowel surgery. The specific location and type of fistula can often suggest certain causes **(Perry et al 2002).**

Table (2): Major causes of acquired small intestinal fistulae

Inflammation
Crohn's disease
Diverticulitis
Infection (atypical)
Cholecystitis
Appendicitis
Pancreatitis
Surgery (Iatrogenic)
Malignancy
Radiation
Aortic aneurysm/graft
Trauma
Foreign body

(Perry et al., 2002)

1-Inflammation:

Fistula formation is a hallmark of Crohn's disease, occurring in up to 20%–40% of patients described in surgical series. Sinus tracts and fistulae often involve the distal small bowel, and peritoneal abscess may be an associated finding. The clinical and radiological manifestations vary widely because these internal fistulae can involve nearly any organ, but ileocolic and enterovesical fistulae are the most common types**.** Fistula formation is considerably less common in ulcerative colitis, which, unlike Crohn's disease, is not a transmural process **(Perry et al., 2002).**

The transmural inflammation that occurs with Crohn's disease leads to adherence of the involved bowel segment to adjacent structures. Microperforation then leads to abscess formation and subsequent perforation

into adjacent structure. Usually this is a loop of bowel, urinary bladder, or vagina(Less frequently it emerges through the skin of the anterior abdominal wall). Fistulae develop in 20% to 40% of patients with Crohn's disease, one half internal and one half external **(Delaney and Fazio, 2001).**

Diverticulitis is a common cause of iliocoloic fistula formation, with the fistula often communicating with the urinary bladder. Other than Crohn's disease and diverticulitis, other less common inflammatory causes of gastrointestinal fistulae include atypical infections, cholecystitis, pancreatitis, and appendicitis**.** Among the various atypical infectious causes that have been reported are tuberculosis, histoplasmosis, actinomycosis, xanthogranulomatous pyelonephritis, amebiasis, echinococcosis, and lymphogranuloma venereum **(Perry et al., 2002).**

2-Surgery (Iatrogenic):

Operations for cancer, inflammatory bowel disease, and lysis of adhesions are the most common operations preceding intestinal fistula formation. In addition, operations for peptic ulcer disease and pancreatitis can lead to postoperative intestinal fistula formation. Fistulae more commonly occur in settings of emergency surgery, for which patient preparation was poor or when the patient is chronically malnourished **(Scott et al., 1996).**

Complications of abdominal surgery are the cause of small intestinal fistulae in 70% to 90% of cases. 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. Thus, half of small bowel fistulae occur after operations in which there has been no resection or anastomosis **(Kuvshinoff et al., 1993).**

3-Malignancy:

Enterocutaneous fistulae that develop in patients with cancer represent a difficult management situation, which is often complicated by prior treatment including surgery, radiation therapy and chemotherapy. A fistula may in turn delay beneficial treatment of the underlying malignancy. **(Perry et al., 2002)**

4-Radiation:

Radiation therapy is another major cause of intestinal fistulae. Although radiation therapy has improved long-term survival in many malignancies, a 5% to 10% incidence of radiation-induced intestinal complications is seen weeks to years after administration. Moreover, bowel resection and anastomosis in irradiated tissues place the patient at increased risk for anastomotic breakdown and subsequent fistula formation and should be avoided if possible **(Scott et al, 1996).**

5-Aortic aneurysm:

This arises when the duodenum is stretched over an expanding atheromatous aneurysm that subsequently erodes into the lumen of duodenum. Aorto-duodenal fistula may occur following reconstructive surgery. In this situation the aortic graft erodes into the adjacent intestine either through a false aneurysm, arising at the site of the suture line of the aortic graft or by direct erosion of the body of the graft into the lumen of the intestine **(Perry et al., 2002).**

6-Trauma:

Both closed and penetrating trauma may lead to injury of the gut. Penetrating injuries are almost explored because the signs of peritonitis or hemorrhage, and the injured gut is detected and treated. However in closed trauma; visceral rupture may remain unrecognized until it presents as an abdominal abscess which following drainage discharges enteric contents. This is particularly the case in retroperitoneal rupture of the duodenum **(Falconi and Pederzoli, 2001).**

7-Foreign body:

Can also be responsible for perforation of the gut wall and fistula formation, ingested bone fragments, needles, hair or pins; can lead to a local abscess formation at the site of perforation with consequent internal or external fistulation **(Perry et al., 2002).**

Enterocutaneous fistulae can be studied under three different **classifications, (**table3) namely anatomical, physiological and etiological classifications.

Table (3): Classification of intestinal fistula and their significance

scheme	Classification	Favorable	Unfavorable
Anatomic	Internal External	Esophageal, duodenal stump, pancreaticobiliary jejunal, small leak, track<2cm.	Gastric, lateral duodenal, ligament of treitz, ileal, Complete disruption, epithelization, Distal obstruction.
Physiologic	Output Low Moderate High	Output does not prognosticate closure. Well nourished, no sepsis, transferrin>200mg/dl	Output does not prognosticate closure. Malnourished, sepsis, transferrin<200mg/dl
Etiologic	Disease process	Appendicitis, diverticulitis, postoperative.	Cancer, inflammatory bowel disease, foreign body, radiation.

(Gonzalez and Moreno 2001)

Anatomic information is the first information gained. These data are most readily obtained by contrast studies or by CT scan. Fistulogram is more helpful in defining the anatomy of the abnormal communications than formal gastrointestinal contrast studies. CT scans may show areas of abnormal bowel which are likely sources of the enterocutaneous fistula but seldom demonstrate the fistula tract proper **(Lambiase et al., 1992).**

The location of the internal opening of the fistula tract is important in the anatomical classification. Distally placed fistulae are more likely to heal. Almost two-thirds of the fistulae were located at the level of the small intestines. The cure rates for small intestinal fistulae were about 50% and so, anatomic information has prognostic significance with regard to spontaneous closure of the fistula tract **(Campos et al., 1996).**

In addition, anatomic information helps in narrowing the differential diagnosis with regard to the etiologic process of underlying fistula. Anatomic characteristics associated with non-healing fistulae include large adjacent abscess, intestinal discontinuity, distal obstruction, poor adjacent bowel, fistula tracts less than 2 cm in length, enteral defects greater than 1 cm, and fistulae arising from certain bowel segments such as lateral duodenum; ligament of Treitz, and ileum. Those anatomic segments with more favorable closure rates include jejunal segments. Notwithstanding previous comments, even when anatomic factors are favorable, the ability to predict spontaneous closure of a fistula tract is inexact **(Scott et al., 1996).**

Intestinal fistulae can be classified into internal and external; some fistulae include both elements and are referred to as mixed fistulae**.**

Internal fistulae can be classified according to the site of communication to:

1- Biliary tract, gall bladder, common bile duct, cystic duct.

2- Pancreas.

3- Vascular system (arterial, venous circulation).

4- Genitourinary tract.

5- Female reproductive systems: uterus, cervix and fallopian tube.

(Dudrick et al., 1999)

Daily output of the fistula is taken into account in the **physiological classification**. If the daily fistula output is less than 200 ml the fistula type is described as low-output, if the flow rate is between 200-500 ml the fistula is medium-output, and if the daily output rate exceeds 500 ml the fistula is designated as high-output fistula **(Gonzalez and Moreno 2001).**

The mortality rate has been reported as about two to three times higher for the high-output fistulae. In addition, daily output is considered to be one of the prognostic indicators for the fistula closure. However, the daily output rate was not found to be a significant indicator of fistula closure **(Gonzalez and Moreno 2001).**

The reason for occurrence of the fistula is taken into account in **etiological classification**. 75% to 85% of enterocutaneous fistulae develop following various surgical procedures. It is reported that in almost half of small intestinal fistulae, there has been no resection or anastomosis **(Falconi and Pederzoli, 2001).**

Pathophysiology of specific types of intestinal fistula:

Duodenal fistulae occur as a complication of gastric resection, duodenal resection, biliary tract procedures, pancreatic resections, right colon operations, and aortic and kidney operations in 85% of cases. The remainders are the result of trauma, perforated peptic ulcers, and cancer **(Desa et al., 1990).**

Appendicular fistulae the least common spontaneous colocutaneous fistulae arise from the appendix, more commonly such appendicocutaneous fistulae occur after percutaneous drainage of an appendicular abscess **(Hill et al., 1988).**

Fistulae that occur after appencedectomy in a patient subsequently found to have Crohn's disease are usually not from the appendicular stump, but arise from the terminal ileum where the active Crohn's segment adheres to the healing abdominal suture line **(Delaney and Fazio 2001).**

Internal fistulae: Approximately, 20%-40% of patients with Crohn's disease will develop internal fistulae **(Greenstein et al., 1989*).*** Together, Crohn's disease and diverticulitis account for most internal fistulae. The fistulae associated with Crohn's disease are usually enteroenteric, enterovesical, enterocolonic, while those from diverticulitis tend to be colovesical in males and colovaginal in females. Malignancies accounts for the remainder of internal fistulae **(Delaney et al., 2001).**

Aortoenteric fistulae are surgical emergencies, and suspicion of their presence in a patient considered an operative candidate is an indication for immediate surgery. Aortoenteric fistulae most commonly occur secondarily after placement of prosthetic aortic grafts. They are of three types: (1) true graft

enteric fistulae in which one of the suture lines, usually the proximal one, communicates with the intestinal tract; (2) a proximal suture line pseudo-aneurysm that has eroded into adjacent bowel; and (3) perigraft enteric erosions in which the midportion of the graft erodes into adjacent bowel, these present with profound gastrointestinal bleeding, perigraft infections, or graft thrombosis **(Orton et al., 2000).**

The Pathophysiology of primary aortoenteric fistulae is virtually always erosion of the aneurismal or infected aorta into surrounding viscera. The remainder of primary aortoenteric fistulae arises from other intestinal and gynecologic processes, such as esophageal, gastric, and cervical cancer, and various inflammatory processes. Diagnosis is difficult and mortality high for these particular types of fistulae **(Kapadia et al., 2000).**

CHAPTER II

DIAGNOSIS OF SMALL INTESTINAL FISTULAE

The diagnosis of developing fistulae is generally reliant on the history of the patient and physical examination. The majority of patients will be recovered postoperatively and a slow or unusual course of recovery is often the first indicating of arising complications. Patients may present with abdominal tenderness, fever, and leucocytosis. In addition, the wound may develop a cellulitic appearance, with excessive drainage or abscess formation. Patients in who skin changes around the wound are observed usually present with enteric contents in the wound or dressing within a 24 - 48 hours period **(Foster and Lefore, 1996).**

Fistulae may drain externally through the skin or internally and the fistula tract may be simple or complex. The characteristics of the effluent can provide an indication to the source of the fistula, for example the odour, colour, consistency, and amount. Furthermore, as an initial step, clinical recognition with methylene blue may be useful. The underlying cause of fistula development 7-10 days after surgery is generally a consequence of anastomotic failure but those occurring later, or spontaneous, require further investigation **(Gonzalez and Moreno, 2001).**

History:

It is Important to obtain a detailed history and perform a comprehensive physical examination. If a patient with a Gastrointestinal fistula has been referred from another hospital for treatment, his or her clinical assessment must include a detailed history from both the referring physician and the patient concerning the original illness, the patient's past medical history including previous operations, and the details of the operative procedure(s) prior to the presentation of the fistulae **(Gonzalez and Moreno, 2001).**

Several questions should be answered at this time:

1. From what region of the bowel does the fistula arise?
2. Is the bowel wall defect larger than 1 cm?
3. Has the bowel been completely disrupted?
4. Does the fistula communicate with the bowel distally?
5. Does the fistula arise from the lateral bowel wall?
6. Is there an abscess associated with the fistula, and if so, does the fistula drain into the abscess cavity?
7. Is the adjacent bowel damaged, strictured, or inflamed?
8. Is there a distal obstruction?
9. What is the length of the fistula?

Internal fistulae are more difficult to diagnose although patients often suffer from diarrhea, sepsis, and dyspnea, as well as air, pus, or faeces in the urine **(Gonzalez and Moreno 2001).**

Investigations:

Once a fistula has been confirmed, the daily output volume should be determined and biochemical (amylase, lipase, bilirubin, pH) and microbiological evaluations should be performed on the fistula fluid. Many techniques are available that can be useful in confirming the diagnosis and identifying the intrinsic anatomical and pathological features of a fistula. These are listed in (table 4).

Table (4): Investigations used in confirming the diagnosis of fistula

** Monitor:
fistula output volume
Fistula aspect (colour, odour, etc.)
water-electrolyte balance
biochemical evaluation (amylase, lipase, bilirubin, pH)
infection status
nutritional and metabolic status
**Methylene blue test
**Upper or lower gastrointestinal endoscopy
**Digestive tract X rays with water soluble contrast medium
**Fistulography with water soluble contrast medium
**Ultrasonography
**Computerized axial tomography
** Magnetic resonance imaging

(Falconi et al., 1999)

Laboratory tests to determine the enzyme content of the exudates are also important in diagnosis, especially when pancreatic involvement is suspected. The fistula output will contain a high concentration of toxic bile acids and active digestive enzymes from the pancreas that are highly corrosive and maintain the patency of the fistula tract **(Foster and Lefore, 1996).**

Discharge from an external fistula should be analyzed for amylase content and if pleural effusion or ascites are present, both amylase and albumin levels should be determined **(Lipsett and Cameron, 1992).**

Following stabilization of the patient and maturation of the fistula tract, the anatomy of the fistula should be investigated radiographically. A fistulogram

should be performed as a collaborative effort between the senior surgeon and a senior radiologist. An adequate fistulogram will obviate the need for other gastrointestinal tract examinations, such as a small bowel follow-through or barium enema **(Gonzalez and Moreno, 2001).**

Radiological assessment:

It is vital to identify the source and route of the fistula tract in addition to aetiological features that may influence the outcome such as the presence of obstruction, abscess, or pancreatic pseudocysts. Comprehensive determination of the anatomical aspects of fistulae is usually obtained through radiological investigation, utilizing contrast studies, computerized tomography (CT) scan, or magnetic resonance imaging. Barium enema may also be beneficial in the investigation of lower intestinal fistulae. In established fistulae, fistulogram may be performed by injecting contrast medium directly into the fistula tract or into previously placed drainage tubes or catheters **(Thomas 1996).**

Following complete visualization of the tract, further investigation to delineate associated pockets and cavities may be performed safely using angiographic catheters and guide wires under direct angle fluoroscopic control **(McLean et al., 1982**).

Fluoroscopic contrast-enhanced studies and conventional radiographic studies have traditionally served as the cornerstone for imaging of spontaneous gastrointestinal fistulae. However, technical advances and the increased availability of cross-sectional imaging modalities have challenged this example. The result has been a more flexible approach that utilizes the strengths of the various complementary imaging modalities now available. The preferred imaging approach will vary according to fistula type and the specific clinical

scenario. Furthermore, even individual fistula types often elude generalization and must be treated on a case-by-case basis. This underscores the importance of the radiologist in determining the most appropriate sequence of imaging studies for a given case. Because many fistulae may be detected incidentally on cross-sectional images obtained because of other indications, familiarity with the direct and indirect signs of fistulae is essential for this unsuspected diagnosis **(Perry et al., 2002).**

Fistulography:

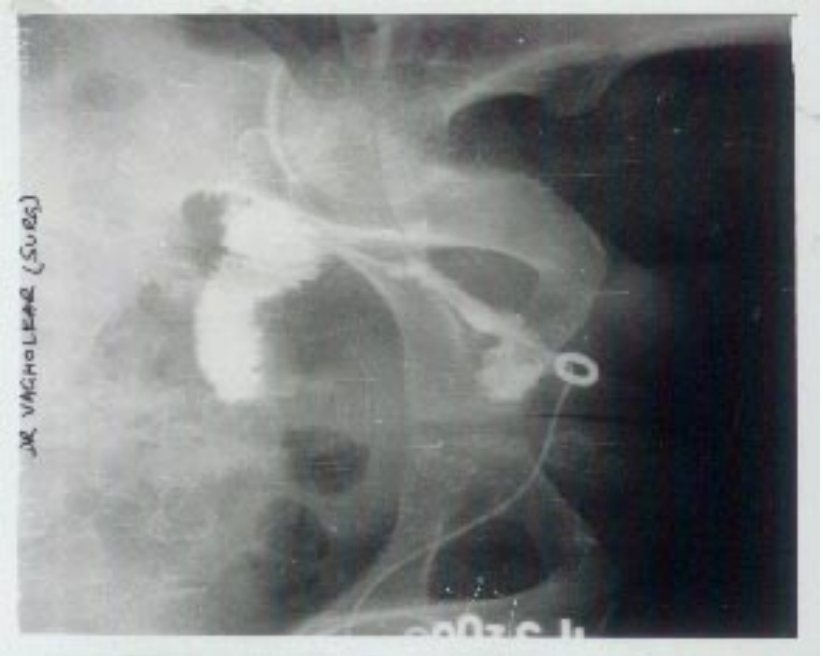
The value of fistulography (sinus tract injection) using water-soluble contrast medium has long been appreciated by general surgeons **(Rubelowsky and Machiedo, 1991).**

Once the tract has been carefully opacified (fig. 1) it can be safely negotiated using angiographic catheters and guide wires under direct- angle fluoroscopic control. In this way, the fistula and any associated pockets and cavities can be opacified and delineated **(Sacks et al., 1982).**

Fistulography may also be performed by directly injecting surgical drainage tubes and catheters that have been previously placed. However, if the drain has multiple side holes, the injected water-soluble iodinated contrast medium exits these holes and flows back to the exterior alongside the drain, thus failing to adequately delineate the fistula and its associated pockets and cavities. In this situation, an end-hole angiographic catheter can be negotiated through the surgical tube or catheter over a torque-control guide wire in co-axial fashion and positioned with its tip beyond the end of the drain. Injection of contrast medium through the angiographic catheter then provides the needed diagnostic information. It should be noted that if a sinus tract or drainage catheter contrast study fails to delineate the cause of ongoing sepsis or drainage, additional

diagnostic imaging techniques such as CT or gastrointestinal contrast studies should be used for further investigation **(Dougherty and Simmons, 1983).**

(Fig. 1)



(Dougherty and Simmons, 1983)

Fistulogram (A-P View) reveals communication with a loop of the small intestine

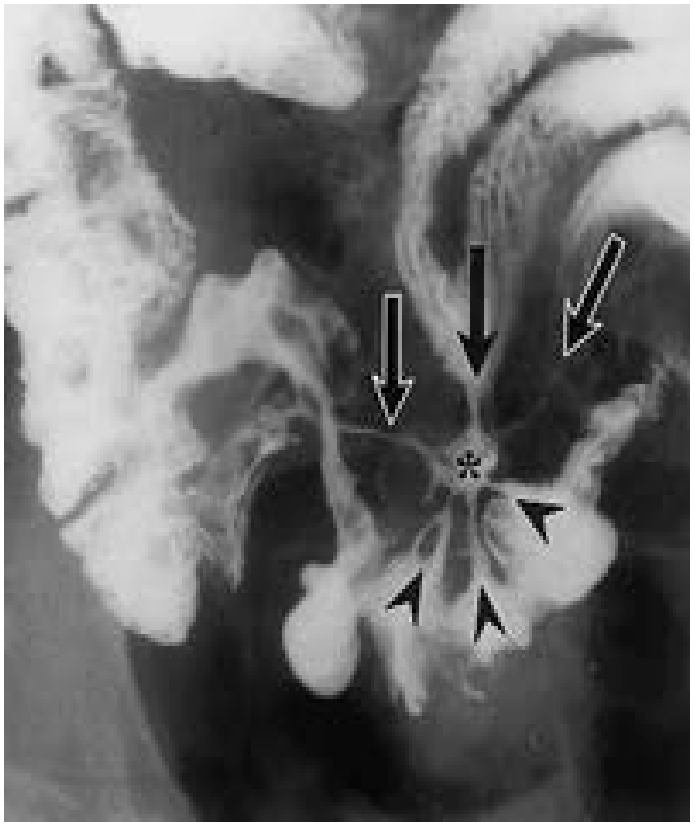
On occasion, enteric contrast-enhanced studies, such as a small-bowel study or enema, will provide as much or more diagnostic information. For extra intestinal internal fistulae, one must decide between pursuing a primary bowel study and a study that directly opacifies the communicating organ system, such as urography, vaginography, cholangiography, and others. For intestinal (gut-to-gut) fistulae, enteric contrast-enhanced studies are superior and may be the only noninvasive method able to demonstrate these fistulae in some cases **(Perry et al., 2002).**

Choice of contrast agent:

The choice of contrast agent is another important factor in the performance of conventional gastrointestinal studies. A water-soluble iodinated contrast agent is generally used, at least initially, for abdominal fistulography and enteric studies when frank perforation is suspected or pneumoperitoneum is present. This is predicated on the potential for extravasated barium to incite an inflammatory reaction in the peritoneum, which can be followed by the formation of dense fibrous adhesions **(Karanikas et al., 1997).** The risk of clinically important chemical peritonitis, however, is minimal unless a relatively large amount of barium has leaked, especially with the newer barium preparations. A similar but more localized and less severe foreign body reaction can occur with retroperitoneal and extraperitoneal barium extravasation **(Walker et al., 1989).**

Despite these caveats, it is important to remember that barium is more sensitive than aqueous contrast agents for demonstrating gastrointestinal fistulae due to the tendency of the later to dilute, resulting in lower radiographic opacity **(Thomas 1996).** When a water-soluble contrast agent is used initially, a negative study should be followed by a barium study when the index of suspicion remains high **(Perry et al., 2002).**

Enteroenteric and enterocolic fistulae are common complications of Crohn's disease, where fistulae are often multiple and favor the ileocecal region (Fig.2) Enterocolic fistulae in Crohn's disease are usually due to primary small-bowel disease, whereas the opposite is true for colonic diverticulitis.



(Fig.2)

Enteroenteric and enterocolic fistulae., Frontal radiograph from barium-enhanced small-bowel study in a 25-year-old man with Crohn' disease shows multiple fistulous tracts extending from the terminal ileum (arrowheads), converging to a small mesenteric cavity (*), and communicating with the cecum and more proximal ileum (arrows).

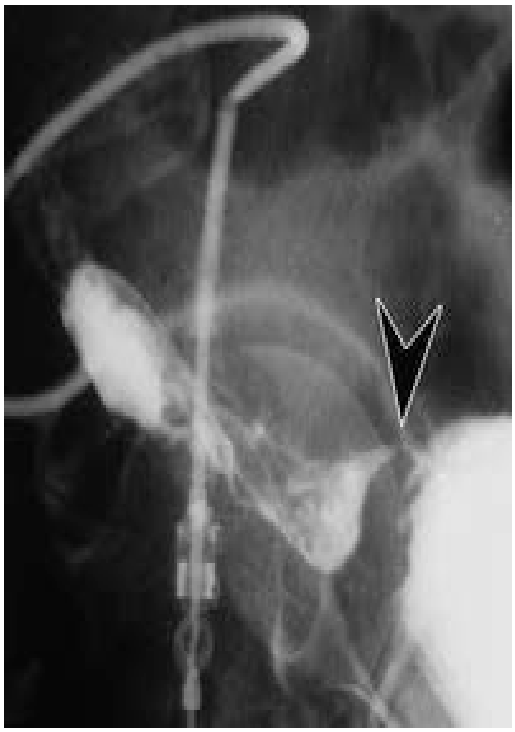
(Woods et al., 1988)

Role of CT:

Cross-sectional imaging, particularly computed tomography (CT), has further strengthened the radiologist for evaluating gastrointestinal fistulae. CT effectively complements conventional radiography with its ability to demonstrate extra luminal disease, including associated abscesses, tumor, or other coexisting processes. Although CT may be less sensitive for direct detection of some gastrointestinal fistulae, there are instances where it may be more sensitive than conventional studies, such as with enterovesical fistulae **(Rubesin et al., 2001).**

Regardless of whether the fistula is directly detected at CT or not, CT often yields more valuable information overall with respect to patient care.

Furthermore, it is important to at least consider the need for obtaining a CT scan prior to performing a conventional barium examination, because residual barium can produce troubling artifacts on CT. Technical advances such as multi–detector row CT allow for effective multiplanar reformations and volume-rendering techniques to directly display fistulae not oriented in the traditional transverse plane. Often, CT directly or indirectly demonstrates the presence of a gastrointestinal fistula, elucidates the underlying cause, and obviates further imaging (fig.3). An additional advantage of CT is its utility in guiding percutaneous drainage of associated abscesses **(Perry et al., 2002).**



Enterovesical fistula, Contiguous transverse CT scan obtained with intravenous and oral contrast agents in a 69-year-old woman with longstanding Crohn's disease show a heterogeneous soft-tissue mass associated with thickened ileal loops and adjacent bladder wall thickening (arrowhead). A small gas bubble is present in the bladder lumen.

(Fig.3)

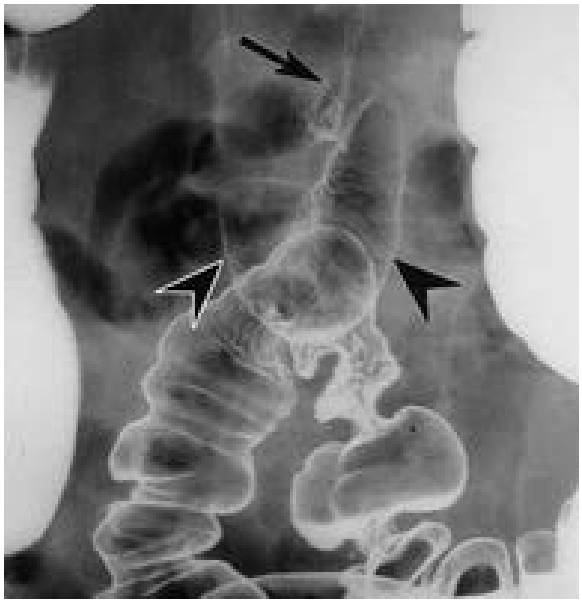
(Perry et al., 2002)

Magnetic resonance (MR) imaging holds similar promise for the evaluation of certain forms of possible gastrointestinal fistulae, but the application of MR imaging has been most visible in the evaluation of enterocutaneous fistulae, especially in the perianal region**.**

Faster imaging sequences and the use of oral contrast agents may further expand the role of MR imaging, but CT remains the primary cross-sectional modality for fistula evaluation because it is rapid, generally available, and less costly than MR imaging **(Morris et al., 2000).**

Ultrasonography plays a much more limited role in the evaluation of most gastrointestinal fistulae and typically requires a corroborative study for confirmation **(Yee et al., 1999).**

In general, **contrast-enhanced fluoroscopic gastrointestinal studies** remain the most effective means for help in diagnosing intestinal fistulae (Alexander et al., 1982).



(Fig.4)

Enterocolic fistula. Spot radiograph obtained during air insufflations for air-contrast barium enema examination in a 58-year-old man shows unsuspected communication between sigmoid colon and small bowel (arrowheads). The patient had undergone successful surgical removal of an infected abdominal aortic graft 6 months earlier. Note also faint contrast agent (arrow) extending along the aortic region.

(Read et al., 1999)

A small-bowel follow-through examination may be the only noninvasive means for detecting some enteroenteric fistulae, but a successful examination requires vigilance and a high index of suspicion by the radiologist (fig.4).

Enteroclysis may be more sensitive for the detection of some enteroenteric fistulae, but it is a more invasive procedure that requires small-bowel intubations. These fistulae tend to be subtle on cross-sectional images but may be detected as a serendipitous finding on occasion **(Lee et al., 2000).**

3-D computed tomographic reconstruction: The use of 3-D CT preoperatively reveals the complex. Anatomy and provide complete anatomical information **(Toshiaki et al., 2002).**

Fiberoptic endoscopy is usually very useful in revealing the underlying disease and enables taking- biopsies for histological examination. Duodenal fistula can easily be visualized with upper gastrointestinal endoscopy, colonoscopy is less valuable because the site of the fistula may be heavily affected by the underlying disease or there may be an obstruction that prevents the passage of the instrument, and however, a diagnostic biopsy is essential to reveal the underlying cause **(El Bahar and Iruing, 1988).**

Hydrogen peroxide enhanced ultrasound-fistulography has been implicated for diagnosis of enterocutaneous fistula complicating Crohn's disease **(Maconi et al., 2002).**

Power Doppler Ultrasonography: The efficacy of power doppler in depicting internal fistulae and their vascularity and characteristics of blood flow within the fistula wall was studied and compared with radiographic, endoscopic, or intraoperative findings. The study revealed increased vascularity in all of the internal fistulae that where subsequently confirmed by diagnostic procedures. In the case of intra-abdominal abscesses in the vicinity of the fistula, vascular signals were detected mostly around and not within the lesions **(Maconi et al., 2002).**

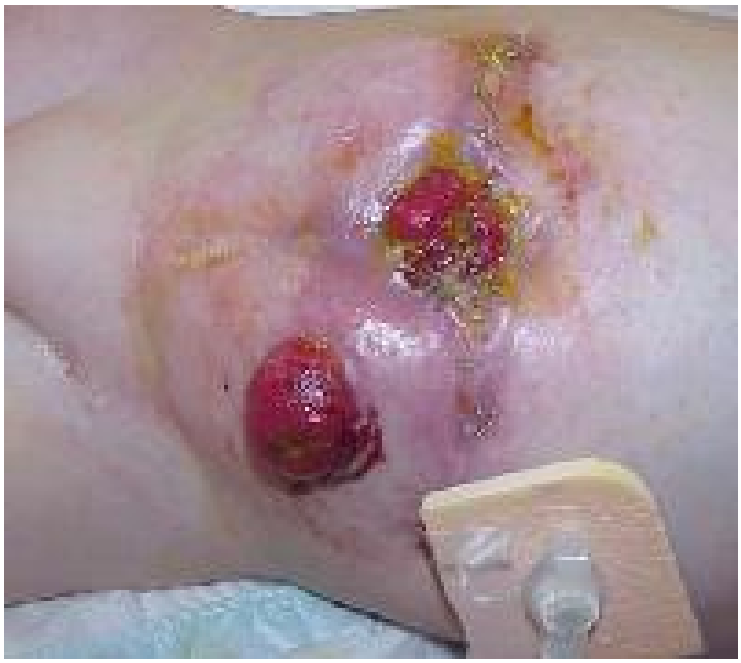
Other investigations-include oral administration of non-absorbable marker such as charcoal or Congo red to diagnose the presence of fistula. Similarly, giving an oral dose of methelene blue which appear on the wound dressing after an interval may confirm the presence of a fistula **(Seymour and Schwartz 1999).**

CHAPTER III

COMPLICATION OF INTESTINAL FISTULAE

1-Sepsis:

Skin irritation and infection are the most common complications with fistulae. Excoriation from stoma effluent, Candida infection (fig.5), and dermatitis are frequent; improper location or construction of the stoma and poor stoma care are often responsible **(Robert et al., 2004).**



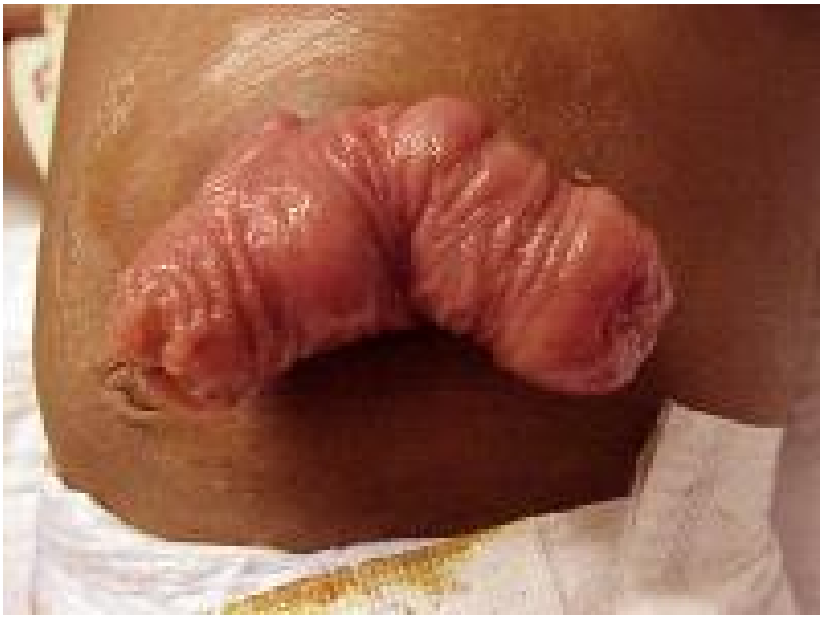
(Robert et al., 2004)

(Fig. 5)

Fistulas of the small intestine, Skin irritation, fistula retraction, and wound infection after placement of a stoma through a laparotomy incision

Wound infection, wound separation, dehiscence,prolapse and postoperative sepsis may also occur after formation of a fistula, particularly if the stoma has been brought out through the wound (fig.6) **(Robert et al., 2004).**

Sepsis however is still a major complication in 25% to 75% of patients with external fistulae. Sepsis is the most common cause of death cited in various series making it mandatory that recognition and appropriate treatment occur at an early stage **(Kuvshinoff et al., 1993).**



(Robert et al., 2004)

(Fig 6)

(Both proximal and distal limbs prolapsed).

2-intestinal obstruction:

Intestinal obstruction also is common. Stoma strictures can occur at the skin and/or fascia levels. Partial obstruction can result in hyper peristalsis and hyper secretion; massive fluid losses through the stoma may result in dehydration. If a stoma stricture is suspected, the size of the opening can be determined by carefully passing metal sounds through the stoma. Attempts at dilating the stoma are usually unsuccessful and may cause intestinal perforation. Passage of a soft catheter proximal to the stricture can provide temporary decompression. Most significant stoma strictures require surgical revision; a local procedure with minimal morbidity is often possible **(Robert et al., 2004).**

3-Psycological trauma:

Psychological issues can be significant for the patient and the family. These effects can be particularly important in adolescents, who are dealing with body image and sexuality. A team approach to providing preoperative counseling, postoperative care, and rehabilitation is crucial to the well-being of the patient. An enterostomal therapist or nurse specialist is essential. The age of the patient and an understanding of physical and psychological changes that children with stomas experience must be carefully considered **(Robert et al., 2004).**

4-Malnutrition:

Malnutrition is common in patients with enterocutaneous fistula, over a period of time, giving rise to alterations in body composition, as well as systemic and multi organ manifestations. Malnutrition is also associated with adverse outcomes, whereas clinical stability is associated with nutritional stability**.**

Estimation of body composition is important in the assessment and monitoring of enterocutaneous fistula patients. Enterocutaneous fistula is a condition in which over nutrition, edema, and under nutrition can coexist simultaneously, or successively, over a period of time, giving rise to alterations in body composition, as well as systemic and multiple-organic manifestations. The development of a noninvasive, inexpensive, and accurate technique to assess body water and nutritional compartment would be of great clinical value to identify those patients with impaired morbidity and mortality in enterocutaneous fistula, and enhanced nutritional support is indicated in those patients with persisting nutritional deficits **(Robert et al., 2004).**

5- Fluid and electrolyte problems:

Physiologic abnormalities related to loss of fluid and electrolytes are common in young patients with fistulae, particularly when the fistula is in the proximal gastrointestinal tract. Fluid and electrolyte losses from any fistula can be significant, and replacement is usually required. The electrolyte composition of enteral fluids is listed in the following Table (5).

(Table 5) Electrolyte Composition of Enteral Fluids

Fluid	**Na^+ mEq/L**	**Cl^- mEq/L**	**K^+ mEq/L**	**HCO_3^- mEq/L**	**H^+ mEq/L**
Saliva	30-60	15-40	20	15-50	N/A
Gastric	60-100	90-140	10-20	N/A	30-100
Duodenal	140	80	5	50	N/A
Bile	140	100	5-10	40-50	N/A
Pancreatic	140	75	5-15	90	N/A
Jejunal	100	100	5-10	10-20	N/A
Ileal	130	110	10	30	N/A
Colonic	60	40	30	20	N/A
Diarrhea	130	30	90	N/A	N/A

(Robert et al., 2004)

Duodenal fistulae may occur after trauma or surgery. Duodenal fistulae typically have high output and, therefore, are difficult to control. Proximal Jejunal stomas also tend to have high-volume output, with fluid and electrolyte losses similar to those of duodenal fistulae, except for a slightly lower sodium loss from the jejunum. Pancreatic and biliary fluids also empty into the

duodenum, and secretion of these fluids may substantially increase if feeding into the stomach is initiated **(Robert et al., 2004).**

Often, the proximal bowel can adapt to the fluid and electrolyte losses of a distal small bowel fistula. After a period of adaptation, the absorptive capacity of the small bowel proximal to the ileostomy increases and the bowel can reduce ileostomy electrolyte losses by as much as two thirds of its initial output. Adaptation of water absorption is a much slower process. Ileostomy output should average 10-15 ml/kg/d. A doubling of usual stoma output should be considered abnormal. Normal ileostomy output results in the loss of 2-3 times the normal amount of salt and water, and patients with these stomas are susceptible to dehydration. In infants, sodium and bicarbonate losses may exceed renal conservation mechanisms. Infants are prone to dehydration, and they may not gain appropriate amounts of weight unless salt and bicarbonate supplementation is provided **(Robert et al., 2004).**

External fistulae are more prone to develop serious and lethal complications. Fluid and electrolyte abnormalities are commonly associated with external fistulae **(Hill et al., 1998).**

Sodium, potassium, magnesium, phosphate and zinc are most commonly affected. The development of malnutrition depends on the fistula output and is more likely in high risk fistulae. The loss of protein rich secretions from the fistula, along with the lack of adequate nutritional intake that may be seen in these patients contributes to malnutrition.

Patients with long-standing ileostomies often have hypomagnesemia and decreased absorption of vitamin B-12 and folic acid. Patients with ileostomies also have a higher incidence of renal calculi and gallstones than that of the

general population. Also, they may have iron deficiency and fat malabsorption **(Robert et al., 2004).**

In summary, potential fistula-related problems include the following:

- Skin irritation - Chemical, mechanical, allergic
- Intestinal obstruction - Adhesion, volvulus, internal hernia
- Wound-related complications - Infection, separation, dehiscence
- Infections
- Ulceration
- Bleeding
- Fluid and electrolyte imbalances
- Psychological trauma. **(Robert et al., 2004)**

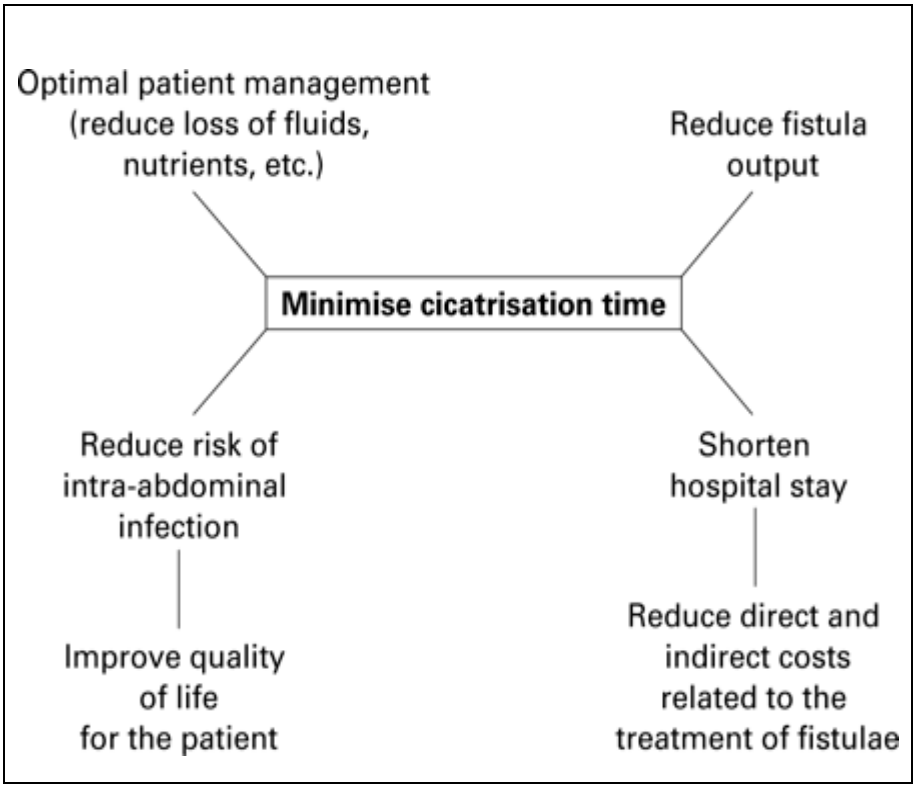
CHAPTER IV

NON-OPERATIVE MANAGEMENT OF INTESTINAL FISTULAE

Goals of treatment:

The main goal of fistula treatment is to achieve closure (cicatrisation) in the shortest possible time (table 6). This can generally be achieved by patient management to the output of the fistula (for example, with pharmacotherapy). Minimizing the cicatrisation time should reduce the risk of infection and shorten hospital stay, hence improving the quality of life for the patient and reducing treatment and hospital costs **(Hesse et al., 2001).**

(Table 6) The goals of treatment for patients with gastrointestinal fistulae



(Hesse et al., 2001)

The treatment of small bowel fistulae depends on several factors, including the fistula location, cause of the fistula, fistula output, nutritional status, and the presence or absence of sepsis. The overall treatment goals in fistula management remain uniform (Table 7) **(Kuvshinoff et al., 1993).**

(Table 7) Treatment goals in small bowel fistulae

Prevent or treat fluid and electrolyte depletion.
Control Drainage
Control Sepsis
Minimize the development of a catabolic state (TPN)
Prevent skin excoriation

(Kuvshinoff et al., 1993)

The key components of nonoperative management of external fistulae are TPN, somatostatin, fluid replacement and aggressive prevention or treatment of sepsis. The use of TPN in patients with small bowel fistulae serves three rules, fluid replacement, electrolyte replacement and alleviation of catabolic state **(Kuvshinoff et al., 1993).**

Once a fistula has been diagnosed; immediate conservative treatment should involve monitoring and control of fluid, electrolyte and acid-base imbalances, as well as nutritional state, fever, shock, and sepsis. Fluid and nutrition levels can be effectively controlled using artificial nutrition, enteral nutrition, parenteral nutrition, or TPN. This initiates gastrointestinal tract rest which may reduce fistula output by decreasing the production of gastrointestinal and pancreatic secretions thereby promoting conditions favorable for spontaneous closure **(Martineau et al., 1996).**

Discussions persist as to the optimal means of providing adjuvant nutritional support. There is an increasing tendency to manage patients with enteral rather than parenteral nutrition. Generally, patients considered to have inadequate gastrointestinal function are given TPN while those deemed to have a functioning gastrointestinal tract receive enteral nutrition. TPN substantially improves the prognosis of gastrointestinal fistulae by increasing the rate of

spontaneous closure and improving the nutritional status of patients requiring repeat operations **(Hesse et al., 2001).**

Specific therapy:

Once the patient has been stabilized; specific therapy can be added if necessary. Generally, surgery is indicated in patients with fistulae that fail to close spontaneously after a 30–60 days period of sepsis; although in some cases surgery can be avoided for at least three months **(Gonzalez and Moreno, 2001).**

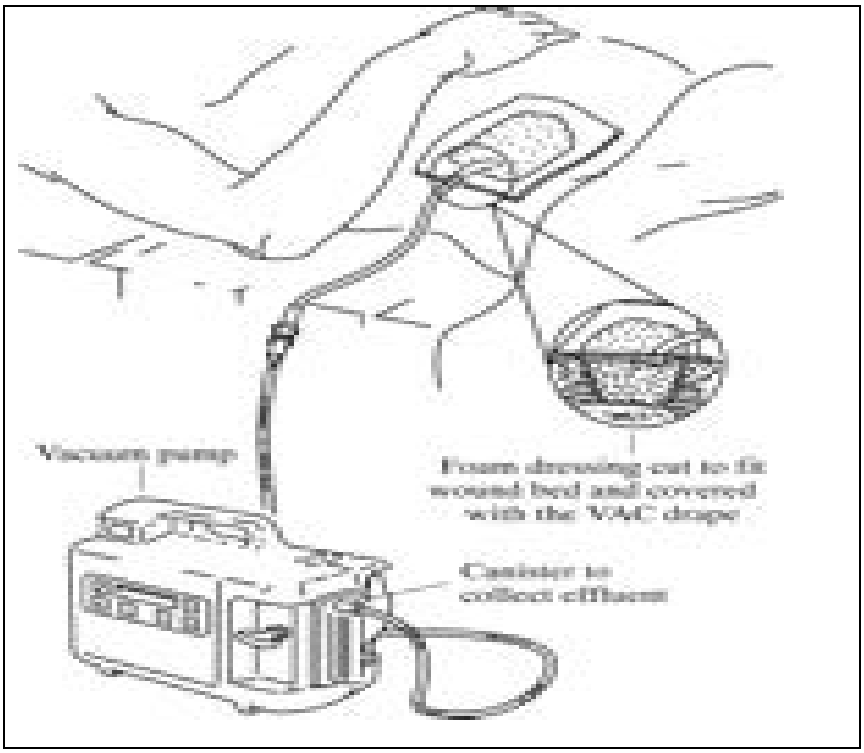
Timing ultimately depends on individual practice and varies between hospitals. Other specific therapies may involve endoscopic or transcutaneous methods of intervention, or drugs that reduce gastrointestinal secretions (for example, somatostatin-14 or its analogue octreotide). Other substances that inhibit pancreatic secretions (for example, glucagon and calcitonin) have also been investigated, although these drugs have little effect on fistula output **(Pederzoli et al., 1986).**

Aggressive antibiotic therapy and care of the skin are the other important aspects which have to be taken care of the chances of spontaneous closure and obviated if the fistula fails to close after 4-6 weeks of aggressive conservative methods. Surgical intervention is therefore warranted in external fistulae as well as in internal and mixed variety of fistulae **(Nassos et al., 1971).**

The VAC system:

The VAC system (fig 7) consists of a portable pump for creating negative pressure, collection tubing, and a canister. The dressing kit includes open cell polyurethane foam dressing which is cut to fit the wound bed and a semi permeable adhesive membrane known as the VAC drape which is used to

seal the foam dressing. A tube coming out of the foam dressing is connected to an adjustable vacuum source via a canister which collects the exudate. Low level vacuum (about 125 mm Hg) is applied either continuously or cyclically (five minutes on and two minutes off has been proved to be more effective) to the wound**.** The dressing is changed at 48 hour intervals **(Cro et al., 2002).**



(Fig.7): The VAC system

The VAC system is thought to work by several different mechanisms. Active removal of excess interstitial fluids from tissues may decompress small blood vessels allowing incremental increases of blood flow and therefore improve supply of oxygen and nutrients for tissue repair. The increased blood flow speeds up granulation tissue formation by 63% over non-VAC treated wounds **(Morykwas and Argenta, 1997).**

Mechanical stress may also play a part by switching on a mechanism which increases cellular proliferation and angiogenesis similar to the Ilizarov

technique. The VAC also leads to reduced bacterial colonisation by anaerobic organisms through increasing tissue oxygen concentrations. Neutrophils use the increased oxygen to kill bacteria. Bacterial colonisation was decreased by 1000-fold compared with non-negative pressure exposed wounds after four days of treatment **(Morykwas and Argenta, 1997).**

However, it has been considered that the use of **subatmospheric pressure** is **contraindicated** in the treatment of enterocutaneous fistulae as it has been believed that it may delay closure of the fistula and may cause damage to internal organs. The VAC system may also promote healing of the fistula (by keeping skin dry and free from effluent) **(Cro et al., 2002)**

Role of Pharmacotherapy in Inhibition of gastrointestinal secretions:

Although it has been shown that TPN has substantially improved the prognosis in gastrointestinal fistula patients, long term supportive treatment of between 22 and 45 days is frequently required to achieve spontaneous closure **(Ysebaert et al., 1994).**

This treatment period is associated with prolonged morbidity, including psychological stress, risk of mortality, and the high costs of hospital care. As a consequence, it is important to discuss healing times and realistic expectations with patients to provide them with a framework to deal with the condition **(Koruda and Sheldon, 1992).**

Furthermore, as morbidity and mortality are associated with fistula output, a strategy to reduce both output volume and the content of corrosive enzymes in the exudate would be likely to decrease the healing time, greatly improving

prognosis (table 8) **(Gonzalez and Moreno, 2001).**

Somatostatin:

The concept of using the ubiquitous hormone somatostatin-14 to inhibit pancreatic exocrine secretion in the treatment of gastrointestinal fistulae was first introduced in 1979 by Klempa and colleagues **(Gonzalez and Moreno, 2001).**

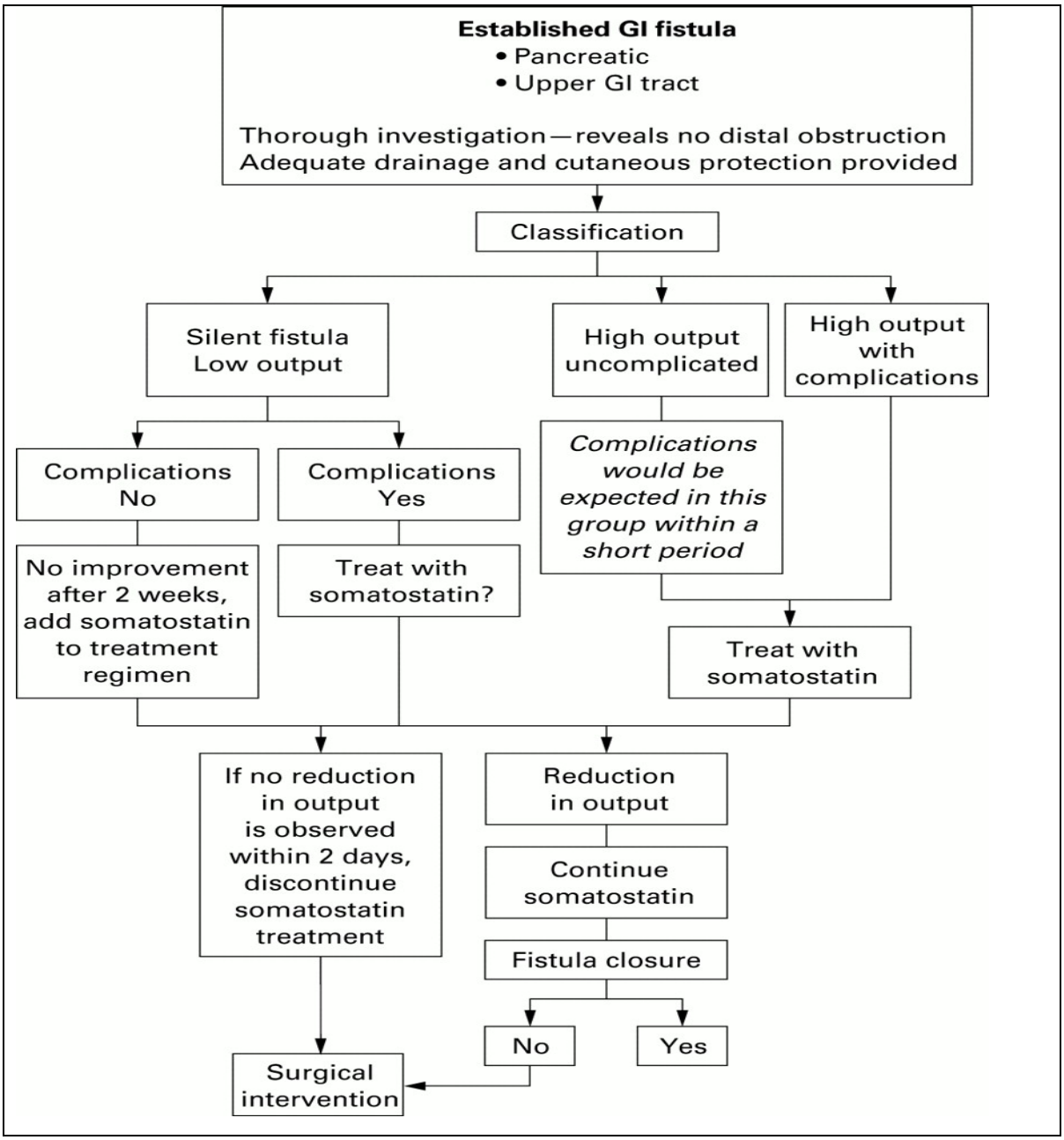
Somatostatin, a 14-amino acid peptide, is a well established inhibitor of gastrointestinal secretion, inhibiting both endocrine and exocrine pancreatic secretion and reducing pancreatic blood flow. Furthermore, somatostatin-14 has been found to exert additional regulatory effects in reducing gastrointestinal motility, gastric secretion, gall bladder emptying, and on secretion of various hormones, including cholecystokinin, vasoactive intestinal polypeptide, secretin, and gastrointestinal polypeptide It also reduces intestinal motility and delays gastric emptying **(Reichlin 1983).**

When used alone, TPN has been found to reduce maximal gastrointestinal secretion by only 30–50% and response to other stimuli persists. In addition, the components of the TPN therapy itself may stimulate pancreatic and gastric secretion, particularly amino acids and lipids. Somatostatin-14 has been found to totally inhibit basal secretion and also to suppress the possibilities of exogenous stimulation **(Reichlin 1983).**

Octreotide:

Octreotide is a synthetic octapeptide analogue of somatostatin-14 which has also found application in the management of gastrointestinal fistulae. Octreotide has a similar pharmacological profile to somatostatin-14 although the half life has been increased to approximately two hours compared with 3 minutes for the native hormone **(Kutz et al., 1986).**

Table 8: Conceptual algorithm for treatment with somatostatin-14



(Gonzalez and Moreno, 2001)

As output losses are associated with a high rate of morbidity and mortality, patients with high output fistulae are likely to benefit to the greatest degree. Both somatostatin-14 and octreotide have demonstrated a significant reduction in fistula output .It is widely accepted that a fistula should be well defined radiographically before embarking on a prolonged and potentially futile

course of treatment. Somatostatin-14 acts pharmacologically and consequently will have no effect as the sole treatment in cases with mechanical obstruction distal to the fistula tract. Complications of this nature require surgical intervention. Nevertheless, while certain well defined factors have been associated with poor spontaneous closure rates and contraindicates the exclusive use of conservative treatment. Somatostatin-14 may have a potential benefit in the stabilisation of the patient prior to surgery, to allow treatment of septic foci and/or malnutrition **(Ysebaert et al., 1994).**

Clinical Data:

There are three parameters that are important in determining the efficacy of gastrointestinal fistula treatments, namely the effects of the drugs on:

- fistula output volume;
- fistula closure rates (percentage of patients whose fistulae close);
- Time to closure.

(Hesse et al., 2001)

Safety profiles:

Both somatostatin-14 and octreotide are associated with favourable safety profiles. In patients receiving somatostatin-14, there were a few reports of blood sugar variations, nausea, vomiting, hot flushes, tachycardia, and diarrhea. In patients receiving octreotide, there were occasional reports of local pain at the injection site, allergic reaction, diarrhoea, and transient hyperglycaemia. The main advantage of octreotide over somatostatin-14 is that it can be administered by intermittent subcutaneous injection. This also means that it can be used occasionally for outpatient management **(Hesse et al., 2001).**

The dose of somatostatin-14 used for digestive fistulae is an initial bolus of 250 µg plus a continuous intravenous infusion of 250µg/h until closure, followed by 3 mg/day (125µg/h) for 48 hours to protect against fistula recurrence. It is important that continuous infusion of somatostatin-14 is not interrupted, and nursing staff therefore have to be extremely vigilant. If continuous infusion is interrupted, a rebound effect may be seen, during which gastrointestinal secretions can increase, and this may lead to reduced efficacy. However, this can be avoided if the infusion is reinstated as soon as possible, together with another bolus of 250 µg. Although somatostatin-14 administration is more complex than that for octreotide, continuous administration may be advantageous in fistula patients, as fluctuations in output volume and/or concentration can generally be avoided**.** Although somatostatin-14 is a relatively expensive treatment, it may help to reduce morbidity, duration of hospital stay, and hospital costs. Therefore, treatment with somatostatin-14 promises to be cost effective **(Hesse et al., 2001).**

Techniques for Feeding the Patient with Gastrointestinal Fistula:

The ultimate choice between TPN and EN will depend entirely on whether the latter method is feasible. The decision is dependent on the site of the fistula but EN is preferred wherever possible as the use of the gastrointestinal tract for nutritional support is the safest and most effective method. Generally, TPN is indicated in patients with gastroduodenal, pancreatic, or jejuno-ileal fistulae and EN is providing for fistulae of the oesophagus, distal ileum, and colon. However, if fistula output is increased or patients are intolerant of EN (for example, high gastric residuals abdominal cramps, or diarrhea)TPN should be substituted. The current generation of enteral diets is superior to parenteral formulations available as they contain glutamine, arginine, fish oils, nucleosides, and nucleotides that all support gastrointestinal mucosal growth and function **(Gonzalez and Moreno, 2001).**

1- Total Parental Nutrition (TPN):

TPN has been the mainstay of conservative management of gastrointestinal fistulae throughout the last three decades. Conservative treatment with TPN has been shown to reduce the maximal secretory capacity of the gastrointestinal tract by 30-50%, induce protein synthesis, and promote favorable conditions for closure **(Gonzalez and Moreno, 2001).**

Venous Access for Total Parenteral Nutrition:

Central Venous Cannulation: Two routes are most commonly used: (1) the infraclavicular, subclavian vein and (2) the supraclavicular internal jugular vein. Both routes are popular and permit the delivery of hypertonic nutrient solutions in a dependable manner. The indication for the use of either route is to provide nutrients for a period greater than 5 days when adequate nutrient intake, to meet the patient's full nutrient requirements is necessary for fistula-related treatment. The benefits of TPN via these routes are legion and have been recently summarized **(Meguid et al., 1993).**

They greatly outweigh the complications that are disproportionately feared. A dedicated central line is usually necessary for the administration of TPN as peripheral veins are soon destroyed by the hypertonic irritant solutions **(Michell, 2002).**

Complications of TPN:

These falls broadly into three categories: mechanical, septic, and metabolic.

A- Mechanical Complications:

The rate of mechanical complications is inversely proportional to the skill and experience of the catheter inserter (Wolfe et al., 1986). In a world review of 39,180 central venous catheters, the most frequent mechanical complication experienced with successful insertion of a subclavian central venous catheter was **malposition** (6%), followed by **arterial injury** (1.4%), **pneumohydrohemothorax** (1.1%), **vessel thrombosis** (0.3%), **thrombophlebitis** (0.1%) (Infusion phlebitis is minimized when peripheral parentral nutrition is administrated on a cyclical basis with rotation of venous access sites) and **catheter embolism** (0.1%).The death rate related to all these complications was 1.2%. The safest route for obtaining central venous access is the internal jugular vein, although this is not the most widely used **(Haffejee, 2002).**

B-Catheter Sepsis:

The overall incidence reported in the literature of central venous catheter (CVC) sepsis ranges from 7% to 27%. It is a well- recognized complication of TPN, in fungal septicemia; the associated mortality varies from 2% to 80%. The most effective method of diagnosis is the quantitative blood culture method for determining in situ sepsis. In all cases, when culture data indicated that the catheter is the source of sepsis, removal of the CVC led to patient improvement. When, based on culture data, the CVC was found not to be the source of sepsis; in no instance did removal of the catheter lead to clinical improvement Following removal of an infected catheter for catheter-related sepsis, data now suggest that it is safe to re-insert a new sterile catheter in 12 hours **(Paston et al.,1993).**

In certain clinical situations (such as critically ill patients for whom removal of the CVC may not be a viable option), treating an established catheter

related sepsis episode with antibiotics can eradicate the catheter colonization, thereby prolonging the life and usefulness of the catheter **(Dourd et al., 1991).**

C- Metabolic Complications:

Because TPN can be considered a sophisticated form of fluid and electrolyte therapy, many of the reported metabolic complications have resulted from errors of omission.

Thus the complications due to an excess or a deficit of electrolytes, vitamins, or trace elements are potentially avoidable (table9). The introduction of a safe and reliable fat source has obviated the metabolic complications derived from a glucose-based TPN **(Meguid et at., 1993).**

Table (9) Complications associated with use of TPN

Mechanical	
Catheter tip malposition.	6 %
Arterial laceration	1.4%
Pneumohydrohemothorax	1.1%
Subclavian or superior vena cava thrombosis	0.3%
Thrombophlebitis	0.1%
Catheter embolism	0.1%
Septic	
Catheter-related sepsis	7.4%
Metabolic	
Acute	Avoidable
Hyperglycemia/hypoglycemia	
Blood electrolyte abnormalities	
Fluid overload	
Hyperlipidemia	
Chronic	Rare
Metabolic bone disease	
Alterations in bile composition	
Deterioration of liver function	

(Micheal et al, 1996)

Standardized TPN Order Form:

Physicians, from consultant staff to house staff, differ greatly in their comfort levels and abilities in ordering parenteral solutions. To aid in delivery of a consistent level of nutritional support care, a parenteral nutrition order form is used. This form is designed for ease of physician use, providing more precise guidelines for the prescription of TPN, including standard orders for starting and stopping TPN and for the comprehensive nursing and dietary care of the patient. The form is based on the single delivery system of the three-in.-one mixture concept and offers the following features: (1) a general purpose standard formula concentration (70g of glucose, 15 g of amino acids, and 30 g of lipids per 1000 mL) or a space for individualized solutions; (2) the average daily recommendations for electrolytes (Na, K, Phosphate, Mg, Ca), vitamins, and trace elements (Zn, Cu, Mn, Cr, Se, Mo) in pediatric and adult dosages; (3) the addition of heparin to prevent catheter thrombosis, (4) the addition of weekly vitamin K; (5) the option to add insulin and an H2 receptor blocker; (6) nursing and dietary orders to start and stop TPN; and (7) laboratory tests to monitor the patient's immediate and long-term tolerance of TPN **(Micheal et al., 1996).**

Three-In-One Concept:

The introduction of 3-L bags made of ethyl vinyl acetate has made the admixture of a fat emulsion to dextrose and amino acids possible. The advantages of this approach are numerous: (1) a cost saving during preparation, handling, and delivery; (2) more uniform administration of a balanced solution containing the three macronutrients plus micronutrients over a 24- hour period, thus circumventing the metabolic disadvantages of a single energy-substrate system; (3) less manipulation and thus less risk of contamination;(4) Obviation of care for peripheral catheters used solely for the administration of lipids in order to avoid inserting a central venous catheter; (5) decreased lipid toxicity

because of the greater dilution of the lipid emulsion and the longer duration of its infusion; (6) ease of delivery and storage for patients on home TPN programs; (7) the option of delivering nutritional support peripherally; and (8) reduced long-term hepatic accumulation of triglycerides, in part attributed to glucose based TPN **(Micheal et al., 1996).**

2-Temporary Home Parental Nutrition (HPN):

Outpatient TPN has potential advantages for both patients and health care providers. The feasibility and safety of its use has been demonstrated in patients requiring permanent home TPN for intestinal failure **(Fustin et al, 2003).**

To- achieve optimal results, there must be a committed team that includes a physician, a pharmacist, and a nutritionist, as well as a reliable and well motivated patient and family. However, unlike for those patients starting on permanent TPN, extensive training is not required **(Cohen et al., 2000).**

Temporary home TPN is administered by visiting home care nurses who don't have any specialized training in the administration of TPN. Also, generally only a few days were required to organize home care nursing and to train patients and their families in the care of the line and the administration of the TPN **(Fustin et al., 2003).**

Although most patients experienced some anxiety before discharge, this generally disappeared soon after discharge. Furthermore, many patients learned to manage their TPN independently, although regular visits by the home care nurses continued. Most patients were able to return to their normal activities. The psychological benefits to the patients and their families shouldn't be underestimsited **(Fustin et al., 2003**).

3-Self-administered subcutaneous fluid infusion:

Administration of fluid and electrolytes subcutaneously, or hypodermoclysis, is an old technique still used in hospital, particularly in the care of elderly and terminally ill patients. When indicated and when small volumes are needed, hypodermoclysis has proved a good alternative to intravenous fluid replacement and has the advantages of simplicity and safety **(Dasgupta et al, 2000).**

Patients should meet the following criteria:

- Short bowel or gastrointestinal failure causing excessive fluid losses and recurrent or chronic deficiencies of water, Na or Mg;
- Such deficiencies persistent despite conventional treatment with diet, drugs and supplements;
- Macronutrient status was at least adequate as judged by BMI. Alternatively, BMI was borderline low but the patient was unsuitable for home TPN, through frailty or other circumstances (**Martinez et al., 2005).**

The patients were trained to self-administer subcutaneous fluids via a fine 20 G butterfly needle, inserted into subcutaneous fatty layer of the thigh, upper arm or trunk. Fluids were infused by gravity drip during 6-12 h overnight. 500-1000 ml of water, 75- 150 mmol of sodium chloride and 2-4 mmol of Mg administered using combinations of 5% dextrose (500ml), 0.9% saline (500-1000 ml) and MgS04. The requirements of each patient were established by titration and serial monitoring of weight, daily oral fluid intake and fluid losses, and serum biochemistry over the first few days and every two weeks. After

discharge, the patients have given phone access to the unit 24 h a day and asked to report any adverse events or difficulties immediately **(Martinez et al., 2005).**

2- Enteral Nutrition: By which food reach the GIT

Techniques of Access:

Nasogastric: When the Gl tract is functioning but the patient will not or cannot eat, then tube feedings should be used. This route of feeding is contraindicated in patients with nausea, oropharyngeal obstruction, or CNS pathology in which the gag reflex is compromised. Nowadays, smaller Silastic nasogastric tubes with weighted tips are available and are well tolerated by most patients. Despite this, subjective distresses of nasogastric tube feeding in rank order include (1) deprivation of the tasting, drinking, and chewing of food; (2) soreness of the nose (3) rhinitis, sinusitis, and esophagitis; and (4) mouth breathing. A distinct disadvantage of the nasogastric route is its decrease in upper airway resistance, thereby interfering with ventilatory exchange, particularly in patients with chronic obstructive pulmonary disease. Under these circumstances an alternate route, as outlined below, is best selected **(Micheal et at., 1996).**

Gastrostomy: In the patient undergoing gastrointestinal surgery, the advantages of a tube gastrostomy for feeding purposes include easy access to the stomach and the bypassing of more proximal mechanical, surgical, or functional obstructions of the esophagus **(Micheal et al., 1996).**

Jejunostomy: If an operation is required to drain localized infection in a patient with esophageal, gastric, or duodenal 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 gastrointestinal fistula (Hill, 2002). A tube Jejunostomy is indicated when prolonged enteral nutritional support is anticipated. The size of the catheter is usually relatively small (No. 8F to 12.F), and its use is indicated when there is a proximal obstruction or fistula in the gastrointestinal tract, in the absence of a stomach, or when recovery of small bowel motility is anticipated long before recovery of gastric motility. The advantages of Jejunostomy over gastrostomy are (1) less stomal leakage and skin erosion; (2) less gastric and pancreatic secretion because the stomach and duodenum are bypassed; (3) less nausea, vomiting, and bloating compared with gastric or duodenal feeding, provided that elemental diets are used; and (4) reduced risk of pulmonary aspiration. As with nasoduodenal or nasojejunal feedings, a continuous infusion of isotonic formula is the optimal method of using this port. A potential problem with intrajejunal feeding when polymeric diets are used is that there may be inadequate mixing of the nutrients with bile and pancreatic enzymes, resulting in incomplete digestion and hence malabsorption. This problem can be obviated by the use of an elemental diet. More recently, Jejunostomy feeding tubes are being placed laparoscopically **(Hill, 2002).**

Fistuloclysis:

A recent study showed that fistuloclysis can effectively replaces TPN as a mean of nutritional support, Feeding was achieved by inserting a gastrostomy feeding tube into the intestine distal to the fistula. Infusion of enteral feed was increased in a stepwise manner, without reinfusion of chime, until predicted nutritional requirement could be met by a combination of fistuloclysis and regular diet, following which TPN was withdrawn.Energy requirement and nutritional status were assessed before starting fistuloclysis and the time of

reconstructive surgery, fistuloclysis was found to replace TPN completely in most patients with no reported complications **(Teubner et al., 2004).**

Technique of Fistuloclysis:

The total length of small intestine above and below each fistula was determined using contrast radiology and by findings at reconstructive surgery where relevant. After confirmation of the integrity and length of the small intestine beyond the most distal fistula opening, the fistula was intubated with a balloon retention gastrostomy tube. The catheter was advanced to a depth of 5-10 cm in the lumen of the distal intestine under radiological control (Figs 8) and 5 ml water placed in the catheter balloon. The fistula was enclosed within a stoma appliance linked to a Hollister universal catheter access port which allowed collection and measurement of proximal enteric content as enteral feed infused via the fistula (Fig. 9). Enteral feeding commenced at an initial rate of 30 ml/h, with a standard polymeric feed and the rate of infusion increased by up to 20 ml/h each day, depending on the patient's ability to tolerate feeding, until a final target feeding rate of 90 ml/h achieved. Patients were fed by continuous infusion, for 12-16h overnight, but encouraged to eat a low-residue diet during the day. To minimize output from the proximal limb of small bowel fistulae, oral fluid intake restricted to a maximum of 1500 ml/day **(Teubner et al., 2004).**

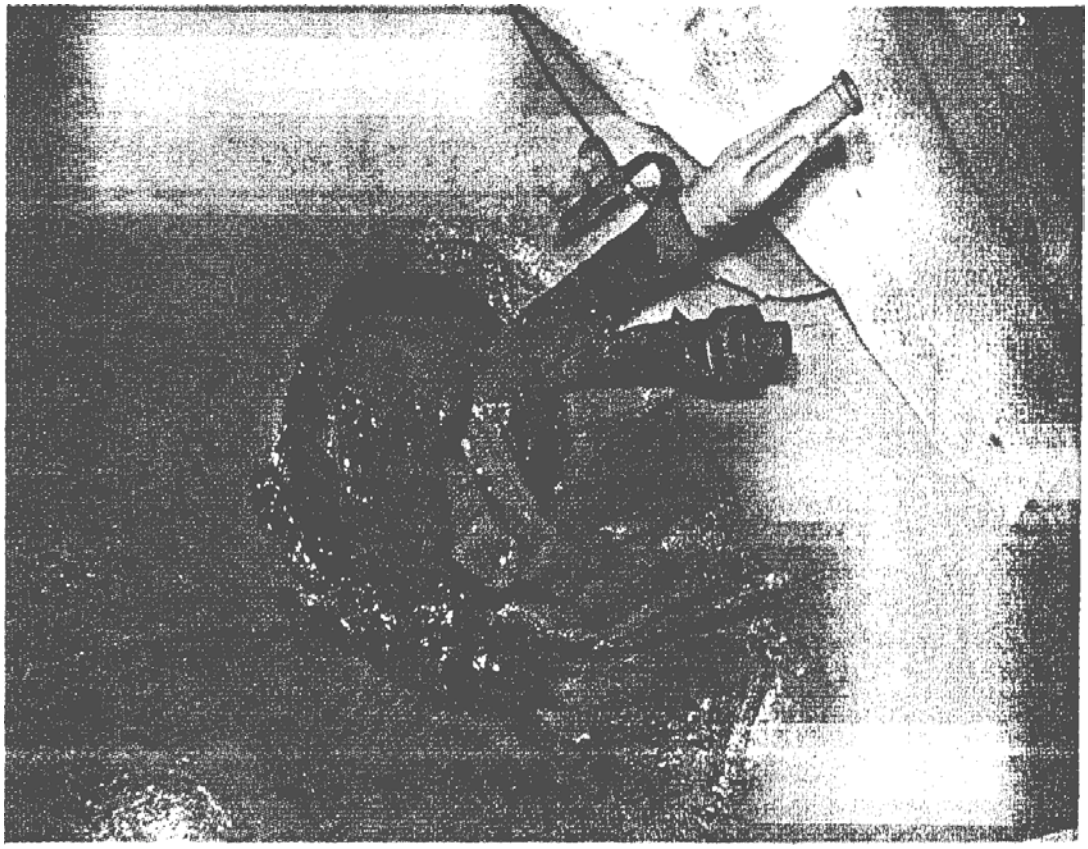


Fig. 8

Fistuloclysis catheter placed in a loop of small intestine fistulating through a laparostomy wound

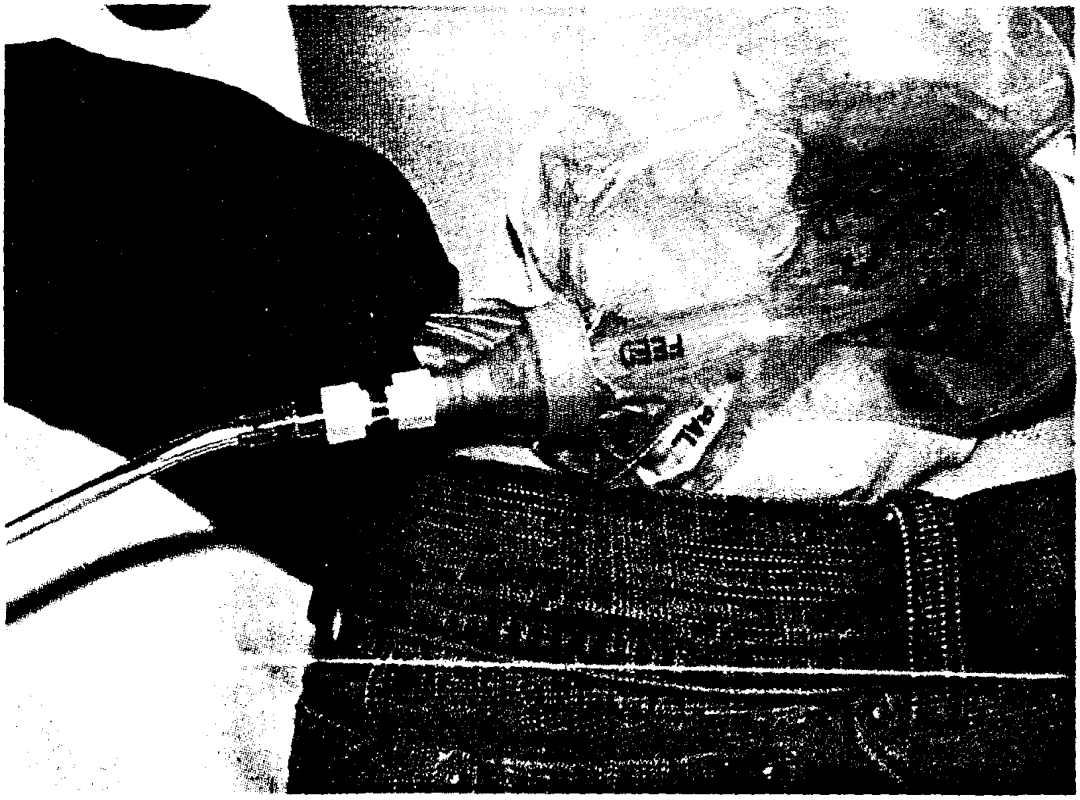


Fig. 9

Stoma appliance with cone system, allowing simultaneous infusion of feed and collection of proximal fistula effluent

Symptoms of feed intolerance (diarrhoea and abdominal pain) were recorded daily. Proximal fistula output and diarrhoea associated with fistuloclysis were controlled in all cases with oral Omeprazole 40 mg twice daily, Loperamide 4 mg four times daily and codeine phosphate 30-60 mg four times daily. Failure to tolerate polymeric feed, or to be able to advance to target feeding rates, resulted in alteration to the feeding regimen **(Teubner et al., 2004).**

Fistuloclysis can satisfactorily maintain nutritional and metabolic status in a group of patients who would otherwise have required TPN. In addition, delivery of enteral feed into the small intestine appeared to be effective, even though no attempt was made to collect or reinfuse chime. Although this seems

surprising, the feeding solution selected for fistuloclysis were chosen because of their high content of medium-chain triglycerides, which may be absorbed in the small intestine (and possibly in the colon), independent of biliary and pancreatic secretions **(Jeppesen and Mortensen, 1998).**

Although fistuloclysis cannot replace parenteral nutrition in the management of all patients with intestinal fistula, it may provide an effective, safe and inexpensive alternative to parenteral nutrition for those in whom secondary intestinal fistulation occurs within an open abdomen **(Teubner et al., 2004).**

Efficacy of Treatment:

Most nutritional support plans encourage the use of the gastrointestinal tract whenever feasible because this mode of nutritional support is safe and effective. The 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 gastrointestinal mucosal growth and function, important for critically ill patients in whom the gut mucosal barrier may become compromised **(Micheal et al., 1996).**

Complications of Enteral Nutrition:

1- Mechanical Complications: The mechanical complications of enteral feeding fall into two broad categories: (low-frequency, high-morbidity complications) and (high-frequency, low-morbidity complications) (Butters et al., 1992).

Low-frequency, high-morbidity complications occurred in less than 5% of patients. But, because of their dramatic nature, many have appeared as single case reports, and they overshadow the general usefulness of this route of feeding. These include injury along the naspgastric tube insertion site, arterial erosion, perforation of the gastrointestinal tract, and aspiration pneumonitis**.** High-frequency, low-morbidity mechanical complications occur in more than 50% of patients and consist mostly of dislodgement of feeding tubes with both weighted and unweighted tips, as well as the red rubber tubes **(Butters et al., 1992)**

2- Metabolic Complications: The metabolic complications and their frequency in enteral nutrition include fluid overload 31%, electrolyte imbalance 30%, hyperglycemia 30%, and uremia and dehydration 15%. Symptoms of abdominal bloating, cramps, and diarrhea are related to high rates of feeding and to the high caloric density of the formula (i.e., high fat content), although paralytic ileus and the side effects of parasympathomimetic drugs must be excluded. These symptoms are more common when feedings are administered via a bolus method, and their frequency can be decreased when enteral feeds are administered on a continuous basis. Among the pathogenesis of tube-feeding diarrhea is the use of contaminated tube feedings, lactose intolerance, intolerance of high osmotic loads, inappropriate release of gastrointestinal polypeptide hormones, concomitant antibiotic therapy, the ingestion of laxatives, and hypoalbuminemia. The use of pectin or mucilaginous hydrophilic colloid bulk laxatives (Metamucil) to promote a formed but soft stool reduces the diarrhea associated with isotonic tube feedings. A number of formulas containing nonviscous, water-insoluble fiber polysaccharides, which are designed to bring the benefits of fiber to the hospitalized and chronically tube-fed patient, optimize normal bowel function. In certain patients, dietary fiber may be contraindicated**.** Risk factors include quantity of fiber ingested, previous

gastric surgery, organic stricture, concomitant illness, and medications that depress gastrointestinal motility and diabetic gastroparesis. In these patients, tube feeding with fiber may not be tolerated and can contribute to fiber bezoars that might need to be surgically removed **(Mclvor et al., 1990).**

3- Infectious Complications: Infectious complications are one of the most commonly reported side effects of enteral tube feeding. Bacterial contamination of the enteral nutrient solution has been reported to occur in 30% to 90% when using open enteral feeding systems. This leads to diarrhea. Other factors include the use of enteral powders requiring mixing and of either sterile or tap water to dilute the formula. A consequence of the diarrhea is its associated increased morbidity related to fluid and electrolyte losses. To minimize contamination of enteral nutrition solutions, it is recommended to use a closed delivery system, a pre- packed sterile enteral formula, and a sterile administration set **(Micheal et al., 1996).**

Indications for Stopping Nutritional Support:

If after the institution of enteral nutrition, formula intolerance occurs, as demonstrated by high gastric residuals, abdominal cramps, increased fistula output, and diarrhea, then enteral feeding should be terminated and TPN should be initiated **(Butters et al., 1992).**

Even in the patient with a gastrointestinal fistula, an endpoint needs to be thought of as soon as TPN is started. This endpoint should be reviewed on a regular basis to ensure maximum benefit and cost effectiveness indicated to the patient's condition **(Micheal et al., 1996).**

Three critical conditions dictate stopping nutritional support:

1. A life-threatening complication may develop which makes temporarily stopping nutritional support a prudent clinical depletion. The complications that necessitate stopping of TPN, at least temporarily, are confirmed sepsis or a severe metabolic complication such as hyperglycemia, nonketotic coma, or hyperammonemia. Sepsis must be suspected in any patient on TPN with fever or hyperglycemia **(Meguid et al., 1988).**

2. The rehabilitative endpoint of nutritional support has been met and surgery is going to closure of the gastrointestinal fistula. For the patient in whom nutritional support is a critical step to full recovery, the theoretical moment for discontinuing supportive nutritional therapy is the point at which maximum benefit has been achieved at the least cost. After Gl fistula surgery, nutritional support should be continued **(Meguid et al., 1988).**

The factors that influence when a patient resumes adequate food intake depend on nutritional status and the occurrence of complications.. Consequently,after successful fistula closure, waiting until a patient eats 60% of his or her requirements, as demonstrated by objective calorie counts, before stepping TPN or distal enteral nutrition (that is, jejunal feeding). Thus, based on inadequate oral nutrient intake period data, TPN is stopped when the patient can eat 60% of his or her estimated caloric requirements **(Micheal et al., 1996).**

3. The patient's underlying disease may have progressed to be terminal. In this type of situation, continuing aggressive TPN is inappropriate, and the decision to stop TPN becomes a difficult one because it implies that the chance of qualitative rehabilitation is negligible. Continuing just for the sake of doing something is inappropriate because the costs of continuing treatment are too

high. An appropriate interim course is to replace TPN with a hydration solution following discussion with the patient and/or the family **(Micheal et al., 1996).**

In all cases, attempts were first made to optimize management of underlying disease to reduce losses and improve residual bowel function with dietetic measures, oral or parentral vitamin, mineral and macronutrient supplements and pharmacological treatment with drugs that reduce gastrointestinal motility, cholestyramine to reduce bile salt malabsorption in cases of ileal resection, suppression of gastrointestinal secretion by H2 blockers, proton pump inhibitors, or somatostatin and its analogues **(Martinez et al., 2005).**

Recent Lines of Non-operative Treatment of intestinal Fistulae:

1- Use of porcine intestinal submucosa:

Recent advances in fistula management include treatment with fibrin sealant after 2 to 3 months of non-operative management. This material is used in a fashion similar to fibrin sealant to heal enterocutaneous fistulae that have been refractory to non-operative management **(Hwang and Chen 1996).**

Technique:

In managed patients, sepsis was controlled with percutaneous drainage and antibiotics. TPN was initiated. After reduction of fistula output to less than 200 ml/day, informed consent was obtained, and patients were taken to the fluoroscopy suite where the fistula was once again demonstrated. A wire was introduced through the original pigtail drainage catheter, and then the tract was dilated to allow placement of a peel away introducer system. The introducer

was withdrawn, and a single sheet of porcine submucosa was moistened with normal saline, rolled into a tight cylinder shape, and delivered into the fistula through the sheath under fluoroscopic guidance. Once completed, the sheath was pealed away, and the entire fistulous tract was filled with the porcine submucosa. A dry dressing was applied, and the patient began a clear liquid diet the next day **(David et al., 2002).**

2- Diagnostic and therapeutic fistuloscopy:

Diagnostic fistuloscopy was carried out using a 5-mm choledochoscope under fluoroscopic guidance. Therapeutic procedures included mechanical debridement, irrigation, and sealing the fistula with fibrin sealant and gelatin sponge. All fistulae healed **(Wong et al., 2000).**

3- Use of Percutaneous techniques for obliteration of enterocutaneous fistulae:

Various percutaneous techniques have been used for non-surgical interventional closure of enterocutaneous fistulae (Bianchi and his colleagues, 1988) failed to close a chronic duodenal fistula using histocryl, but achieved success with percutaneous catheterization and injection of prolamine, and amino acid polymer.

The chances of success in sealing fistulae in the alimentary tract depend mainly on the size of the defect and the regeneration capacity of the tissue lining the lesion. Extensive defects between two organ systems are not suitable for glue treatment alone. Placement of covered endoprothesis may be more suitable in such cases. Also, wherever the sealant encounters damaged epithelium, it is of little use. When referred such cases, generally try to roughen the fistula tract with brush forceps in order to try to stimulate epithelialization before injecting

the sealant **(Sabharwal et al., 2004).**

Percutaneous obliteration of the duodenal fistula was successfully performed using gel foam injection through a catheter. This procedure is safe, simple and cheap and further experience may demonstrate that it is an easy and more practical tool in dealing with this problem **(Khairy et al., 2000).**

4- Electrical nerve stimulation in the management of enterocutaneous low-output fistulae:

Two patients with low-output fistulae after surgery were treated with electrical nerve stimulation (ENS). Ultrasonography was useful for the application of this treatment method and for the charting of its progress. Fistula output diminished rapidly in both cases, and the closure of the track was achieved after several sessions of ENS. The procedure is simple and safe and is suggested as an option for the treatment of low-output enterocutaneous fistulae **(Berna et al., 2001).**

5- The role of lnfliximab in the management if non-Crohn's as well as Crohn's induced intestinal fistulae:

Infliximab, a monoclonal antibody against tumor necrosis factor, is an effective maintenance therapy for patients with Crohn's disease without fistulae. A recent study including patients with chronic fistulae not associated with inflammatory bowel disease showed a marked response to a single dose infusion of Infliximab with complete closure of the fistulae **(Date et al., 2004).**

Disadvantages of conservative medical therapy include:

- High morbidity and mortality associated with prolonged hospitalization and long duration of treatment;
- An unsatisfactory closure rate (24–72%);
- High cost;
- Complications of long term TPN (sepsis, central venous thrombosis, and liver disturbances);
- Complexity of wound care and personal hygiene;
- Psychological effect on self image and self esteem;
- Reduced quality of life;
- Delay in return to social and work activities;
- Anxiety about future operative procedures and possible death.

(Martineau et al., 1996)

CHAPTER V

OPERATIVE MANAGEMENT OF SMALL INTESTINAL FISTULAE

Surgical Management of Small Intestinal Fistulae:

Although progress is recognized when it occurs, the duration of nutritional support and supportive medical treatment varies from patient to patient. Each patient should be individualized and the decision to operate should be made after careful assessment of the patient's hospital course and in the context of the patient's disease process and current problem. It is essential, however, that the site and nature of the fistula be defined early and that any conditions likely to prevent spontaneous closure be identified **(Michael et al, 1996).**

Exteriorization of the affected bowel ends followed by definitive surgery after 12 weeks i.e. after the intra abdominal septic process has been treated remains the mainstay of surgical treatment. Patients who present with factors that is poorly prognostic for conservative treatment (for example, obstruction of the intestinal lumen downstream of the fistula) will require surgical intervention. Surgical treatment will also be required for persistent fistulae that fail to close after prolonged conservative treatment The primary aim of surgery in such patients is correction of the mechanical anomaly preventing closure **(Ridgeway and Stabile, 1996).**

However, failed conservative management can be difficult to define and how to progress should depend on the following considerations:

1- Was the conservative treatment optimal?
2- Is there a clear anatomical reason to prevent healing?
3- Has nutritional status been effectively addressed?
4- Has sepsis been controlled; and is the patient fit for surgery?

(Rolandelli et al., 1996)

Generally, surgery is indicated in patients with fistulae that fail to close spontaneously after a 30–60 day period of sepsis free parenteral nutrition**,**although in some cases surgery can be avoided for at least three months **(Gonzalez et al.,2001).**

Rinsema and his colleagues recommend that surgery can be postponed for 2 months, when the abdominal cavity and intestinal adhesions are accessible to relatively easy dissection with substantially less risk for recurrent iatrogenic injury**.**

Furthermore, as the presence of obliterative peritonitis makes operative dissection particularly hazardous, a sepsis free stabilisation period of approximately six weeks with inflammatory quiescence may allow abdominal adhesions time to resolve, potentially reducing surgical risk **(Rubelowsky et al.,1991).**

The timing of fistula surgery was found to have little impact on the fistula closure rate although better results were obtained when reconstructive surgery was deferred beyond six weeks from fistula onset **(Dardai et al., 1991).**

Evaluating the time in which spontaneous closure occurs, Reber et al. (1987) observed that whereas some patients have been treated for many months in the vain hope that the fistula might close spontaneously, 90% of their patients who closed their fistulae did so within 1 month after infection was eradicated. Less than 10% of fistulae closed in the 2 months thereafter, and none closed spontaneously after 3 months of nonsurgical therapy. If a fistula has not closed within the first month or so after sepsis is controlled and while the patient is still receiving adequate nutritional support, operative closure should be scheduled because relatively little chance (<10%) exists that operation will not be required

eventually. Even if spontaneous closure does not occur, a period of 4 to 6 weeks is often invaluable in improving the patient's nutritional status and overall condition prior to operation, allowing restoration of a positive nitrogen balance and subsidence of inflammation **(Reber et al., 1987).**

The presence of multiple fistulae arising in an eviscerated wound is a more challenging problem. The reported mortality for this group of patients varies from 25% to 60%. In such cases, spontaneous closure is rare and reconstructive surgery is invariably required **(Fustin et al., 2003).**

Surgical Management of Sepsis:

General Principles:

Definitive surgical treatment of the fistula should not be combined with drainage of an abscess**,** frequently**;** it may result in recurrence of the fistula or spread of the infection to previous uninvolved areas of the abdomen. Before definitive surgery is undertaken, the large bowel should be mechanically prepared and systemic prophylactic antibiotics given. More conservative surgical treatments, such as bypass procedure or partial or total exclusion, have a high failure rate and should be reserved for poor-risk patients accompanied by drainage of abscesses in order to eliminate life-threatening sepsis and allow some time to prepare the patient for a subsequent radical procedure **(Rolando and Joel, 1996).**

Re-operation for septic patients in association with gastrointestinal fistulae is a major undertaking and is often characterized by significant morbidity and mortality. The decision to proceed with operation in this setting should be undertaken only after all options have been thoroughly considered and

risk versus benefit assessed **(Rolando and Joel, 1996).**

In most cases of patients with gastrointestinal fistulae, when the indication is sepsis or a sepsis-related complication, the procedure is generally performed on an emergent or semi-urgent basis. Given that most of these patients have undergone one or more recent operations, the risk of excessive blood loss are genuine as a result of vascular and often tenacious adhesions. Blood and blood products should be made available and the patient's hemodynamic status optimized prior to surgery. A strategy for debridement, creation of stomas placement of tube enterostomies, drainage of abscess, and wound closure or management should be carefully considered prior to surgery. Consideration should be given to peri-operative consultation with enterostomal therapists, interventional radiologists, infectious disease specialists, and plastic surgeons as appropriate **(Rolando and Joel, 1990).**

Crohn's abscess drainage:

An algorithm for management of sepsis radiological or surgical drainage of a *Crohn's* abscess may be an effective temporizing measure to down grade intra-abdominal sepsis, but definitive resection of the affected bowel segment with simultaneous drainage will inevitably be required in most patients **(Ayuk P et al., 1996).**

The presence of associated sepsis in Crohn's disease is a key factor in decisions surrounding surgical management of these patients. In a large series, 13% of all operations for Crohn's disease were complicated by leak, abscess and fistula formation. These complications were associated pre-operatively with a low serum albumin level, and steroid use, and intra-operatively with the presence of an abscess or fistula **(Yamamato et al., 2000).**

Work Up:

The first step in surgical management should, therefore, be elimination of all intra-abdominal sepsis whilst correcting any nutritional depletion. This may require primary surgical resection with drainage of the abscess. In a normally nourished patient with a serum albumin level above 30 g/L and with no evidence of sepsis, it may be safe to perform resection and primary anastomosis away from the abscess cavity. Conversely, in patients who are malnourished, with an albumin level below 30 g/L and with evidence of sepsis, resection should be combined with exteriorization of the bowel ends as an end stoma and mucous fistula. Laparoscopic or laparoscopic-assisted resection in patients with fistulating Crohn's disease has been described but a laparotomy approach is still probably most appropriate for complex fistulating disease **(Hasegawa et al., 2003).**

The principles for management of infected wounds in patients with gastrointestinal fistulae are similar to those for any infected wound, debridement of necrotic and infected tissue and exposure of all areas for packing. A particularly difficult problem in some of these patients is the presence of prosthetic material in the wound such as polypropylene mesh. This is often part of the pathogenesis of the fistula and a key factor in its failure to do spontaneously. Although removal of the prosthetic material is essential to treat the local sepsis and accomplish closure, this should be undertaken with great care because this seemingly benign procedure can be associated with the risk of creating more fistulae. It is often preferable to partially excise the mesh over several settings as it becomes loose, rather than attempt to remove it en mass when it is embedded in the serosa of the intestine. The greatest challenge of fistula management may be to achieve wound coverage for a large, open, septic wound. Although primary closure may be the goal, it is often not feasible and, alternative measures need to be used to prevent further fistula formation. This

can often be accomplished by skin grafts or flap rotation. Each of these procedures has its own potential drawbacks, and once again, any decision regarding their use should be carefully thought out. With the use of temporary prosthetics, wounds can be left open, with careful attention to dressing changes **(Rolando and Joel, 1996).**

In general, it is best to identify and localize the intra-peritoneal location of the septic focus prior to re-exploration. The operative incision and approach should be governed by the nature and location of the infection, prior operations, and the surgeon's experience **(Hill, 1983).**

The act of re-entering the abdomen in a patient with gastrointestinal fistulae may be quite challenging, and the rushed or inexperienced surgeon may worsen the situation by creating enterotomies in an attempt to gain entry into the free peritoneal cavity. The ideal approach in this situation is controversial; whereas some advocate a new and separate incision through virgin territory, others prefer to go through the previous incision and attempt to isolate the fistula as a pedicle and carefully separate the incision from the viscera. The first approach carries a lower risk of producing inadvertent enterotomies and is very advantageous when the patient had a small lateral laparotomy, such as a McBurney incision. However, the reality is that this approach is often not feasible. Often one has no choice but to re-operate through a prior incision **(Rolando and Joel, 1996).**

To approach the abdominal contents as a block and attempt to separate the abdominal wall from the abdominal contents without trying to dissect the different loops of small bowel is preferred. It is often best to try to develop a plane of dissection as far from the fistula or septic focus as possible. This reduces blood loss and allows one to deal with softer adhesions and more well-defined tissue planes. Clamps are placed on the edges of fascia and exposure is

provided by upward traction on the abdominal wall with simultaneous, gentle downward counter traction on the abdominal contents. The nature of the adhesions dictates whether scissors or scalpel should be used in the dissection. At this stage of the operation using electrocautery is refrained. An enterotomy created by a sharp instrument is more likely to heal than one produced by an electrocautery burn. Advancement of the dissection to both flanks is carried out until a plane of peritoneal cavity free of adhesions is reached. At that point we place a self-retaining retractor and proceed to free up the abdominal viscera. It is essential to expose the entire gastrointestinal tract to be sure that there are no points of obstruction distal to the fistulous opening **(Rolando and Joel, 1996).**

Abscess cavities are drained, sampled for cultures, and irrigated. Silastic sump drains are left to drain any suspicious areas, particularly those with sticky fibrinous exudates. The drains should be brought through the abdominal wall with counter-incisions low in the flanks to offer the most dependent drainage from a supine position **(Rolando and Joel, 1996).**

A number of maneuvers have been described to deal with fistulae such as serosal patches, Roux-en-Y enterostomies to the fistulous tract, duodenal exclusion, and bypasses of the fistulous tract. These procedures are not indicated in a septic patient with an abdominal collection and should be reserved for a later time when the inflammatory process in the abdomen has resolved **(Conter et al., 1996).**

Limited rules:

When operating on a patient with sepsis associated with a gastrointestinal fistula, one should be concerned about the limited rules for new gastrointestinal anastomoses. Particularly if associated with some element of malnutrition

anastomotic leak is likely and should therefore be avoided if possible. If a direct procedure on the gastrointestinal tract is deemed essential, consideration should be given to a proximal, diverting stoma. This decision-making process may be relatively straight forward for patients with distal small bowel. Most patients with fistulae in this region do well with an ileostomy and are still able to eat orally. Placement of a transgastric jejunal tube has proven to be useful in diverting gastric and biliopancreatic secretions. Several types of such tubes are commercially available. These arc double-lumen tubes with one port draining the stomach and the other normally used for Jejunal feedings. The advantage of this type of tube over two separate tubes, a gastrostomy and a jejunostomy, is that by intubating the pylorus, the openings of the tubes in the stomach are directed down into the most dependent area, where fluid accumulates. Plain gastrostomy tubes fail to decompress the stomach because when the patient is supine the stomach has to fill with fluid before draining through a gastrostomy. In the case of a patient with a duodenal or a jejunal fistula, the jejunal port can also be used for decompression instead of feedings **(Conter et al., 1996).**

In addition to establishing access to the gastrointestinal tract proximal to the fistula, one or more sump drains are placed in close proximity to the fistulous opening in the bowel. Some surgeons have tried and reported on the use of tubes placed through the fistulous opening, typically a T- tube **(Rolando and Joel, 1996).**

Drainage:

Following surgery, drainage is provided to prevent the progressive accumulation of fluid and the development of infection. Furthermore, drainage will not only help prevent pain and potential complications such as ileus, fever, and sepsis, it will also aid early recognition of anastomotic leakage and simplify the diagnosis of a developing fistula in terms of the site and enzymic

involvement. The prophylactic use of drainage following surgical procedures with an inherent risk of fistula development is dependent on the type of surgical procedure performed and the experience of the surgeon. Generally, drains are placed near upper digestive anastomoses and sutures with a high risk of fistula formation (for example, oesophagojejunostomy, gastrojejunostomy, duodenal stump, duodenal lateral suture, choledocoduodenostomy or choledocojejunostomy, pancreaticojejunostomy, and pancreatic suture). Sutures with lower risk, such as gastrorrhaphy after gastrotomy, pyloroplasty, and jejunojejunostomy are usually not drained. In the upper abdominal cavity the use of suction drains are currently favored over passive drains. A silicone multiperforated drains with a low aspiration pressure are preferable to the classic rigid plastic drains with high suction pressure as they cause less irritation to surrounding tissue **(Hochberg et al., 1997).**

Types of drain:

Closed suction drains have low infection rates but they often become blocked early in the wound healing process (Berlin et al., 1992). Passive drains are often less efficient and may become contaminated as the upper abdominal cavity has a negative pressure during inspiration (Gonzalez and Moreno, 2001). If anastomotic or suture leaks develop and drainage provided is inadequate, fluid collection with focal or generalized peritonitis may manifest. In most cases, localised fluid can be drained percutaneously with radiographic guidance. However, reoperation may be necessary if percutaneous drainage is unsuccessful or where fluid collection is multiloculated or access to the site of the collection is poor **(Stylianos et al., 1989).**

Reoperation is also necessary in cases of generalized peritonitis and systemic toxicity from an intra-abdominal abscess (Hochberg et al., 1997).

Passive drainage is utilized where the consistency of the fluid collection is viscous but suction drains are preferred if collection is of a more liquid consistency. Usually, low pressure closed drains are sufficient but in cases with a high volume of fluid or a system open to the air, continuous aspiration will be required **(Gonzalez and Moreno, 2001).**

Adequate drainage also allows:

-A more exact guide to volume and electrolyte replacement;
-Evaluation of the progress of therapy;
-Protection of the skin, as the fistula fluid can be corrosive.

(Martineau et al., 1996)

Closure of the laparotomy incision:

Another potential problem in the overall surgical management of patients with sepsis associated with gastrointestinal fistulae is the closure of the laparotomy incision. By the end of a laparotomy for drainage of abscesses, the intestine is often edematous and filled with fluid, creating a much larger volume than that found upon entering the peritoneal cavity. This creates increased tension on the abdominal wall when trying to re-approximate the edges of fascia. Under these circumstances there a few options. One is to "milk" the intestinal contents back into the stomach and aspirate them via the transgastric jejunal tube, gastrostomy, or jejunostomy **(Mucha, 1996).**

Some surgeons have proposed placing long tubes in a retrograde fashion via a cecostomy or even an appendicostomy. Unfortunately, luminal decompression is usually not sufficient to reduce the tension of the abdominal wall upon closure. One technique commonly used in trauma patients is the application of polypropylene mesh. However, Using a prosthetic material over the friable intestine of patient with fistula and peritonitis is not preferred. Instead, using unilateral or bilateral bipedicled flaps of abdominal wall created by flank

incisions is preferred. The entire rectus sheath on each side can be mobilized medially. The defects left on the sides of the abdomen can be covered with split-thickness skin grafts at the same setting or in a subsequent procedure **(Fry and Osler, 1996).**

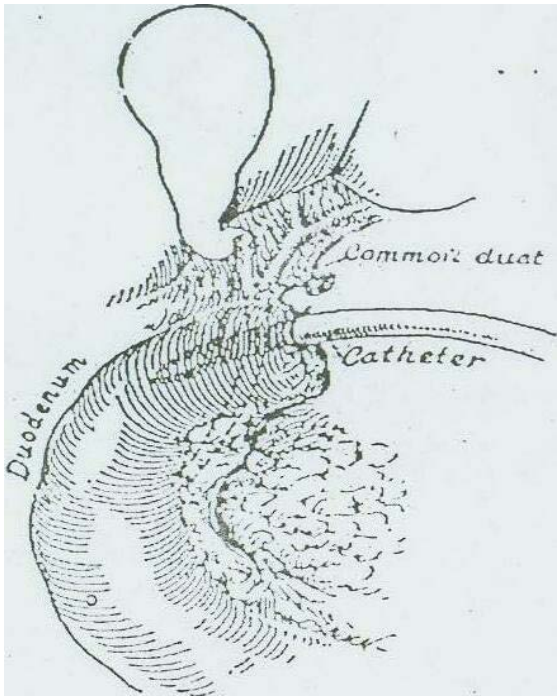
Abdominal closure is mandatory after fistula reconstruction to cover the anastomosis and prevent the suture line from breaking down and refistulating. Relaxing incisions and the use of suture techniques such as near and far closure help to bring the large abdominal wall defects encountered after laparotomy together **(Malik et al., 2001).**

It cannot be stressed too strongly that early operative intervention should always be avoided unless it is to drain sepsis, raise a stoma, resect ischaemic bowel or to exteriorise a fistula. Access to the peritoneal cavity for definitive reconstruction requires its reconstitution from the obliterative phase seen after intra-abdominal sepsis, fistulation and surgery. This may take up to 6 months to occur and can be assumed clinically by the prolapse of fistulae through the abdominal wound ,The use of prosthetic mesh directly over the anastomosis should be avoided due to the risks of refistulation **(Slade and Scott, 2005).**

Definitive Surgical Management of Duodenal Fistulae:

Simple closure or repair of an established duodenal fistula is associated with a high likelihood of recurrence, therefore when primary closure is attempted, omental or serosal patch reinforcement. Exclusion and bypass with tube duodenostomy should also be performed .The exclusion of a fistula is usually reserved for the very sick patient. It is often not the treatment of choice, as it requires a second surgical procedure to restore intestinal continuity after the fistula heals. Briefly, this procedure involves resection of the diseased segment

followed by exteriorization of the ends (fig.10). If the duodenum cannot be exteriorized, a duodenostomy tube is placed. This operation converts an uncontrolled anastomotic leak into a controlled external fistula. It is most useful in the patient who is very ill and in the presence of ongoing sepsis. It avoids the difficulty and likely failure of an attempt at anastomosis in a contaminated field **(Maureen et al., 1996).**



(Fig. 10): Exteriorization of the duodenal stump-catheter duodenostomy. A catheter may be placed directly in the stump of the duodenum, which should be closed carefully around a 14-F whistle tip or a Foley catheter. A purse string suture is used to hold the catheter in place. The catheter is wrapped with omentum and brought through a stab wound in the abdominal wall, leaving some slack to allow for postoperative abdominal distention. A separate drain is placed in the area of the duodenectomy and brought out through a separate stab incision **(Rolando and Joel., 1996).**

Resection of the anastomotic leak is usually the operation of choice. The diseased segment is resected and a new anastomosis is performed. This technique should not be done if the new anastomosis is in a contaminated field or if ischemia or tension on the anastomosis is present **(Rolando and Joel, 1996).**

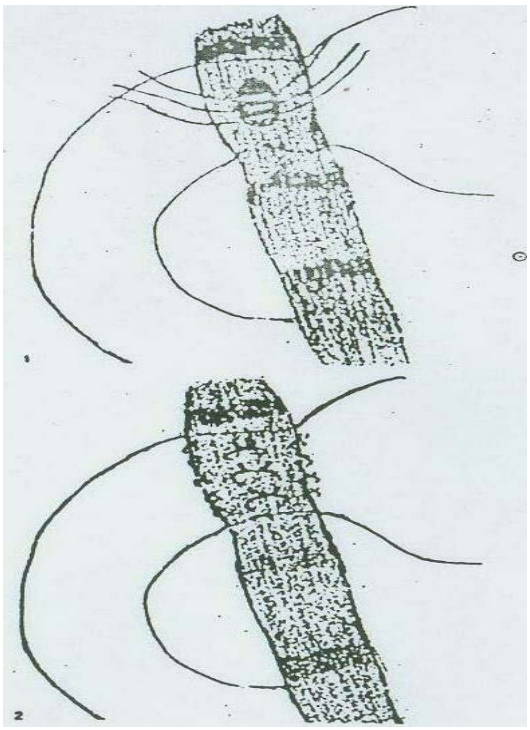
Often it is not possible to resect the diseased segment without a major surgical operation, and closure of the defect is the surgical procedure of choice.

Closure of such defects may lead to compromise of the lumen, particularly for lateral duodenal fistulae. These patients can be managed with a serosal patch or Roux- en-Y anastomosis **(Maureen et al., 1996).**

Experimental studies have shown that the patched serosa becomes lined with duodenal mucosa. The bowel to be patched must be cleaned of fat and have an adequate blood supply. The edges of the defect are approximated, if possible. The defect can then be patched with jejunum or a defunctionalized Roux limb, taking care that the sutures are placed serosa to serosa. A benefit to using a limb of bowel is that if the sealed defect leaks again, the leak will be contained within the intestinal limb **(Maureen et al., 1996).**

A novel technique for repair of a post-operative duodenal fistula was described by Chander and his colleagues (2004) with a rectus abdominis muscle flap. The rectus abdominis muscle was detached from its superior attachment and mobilized from the rectus sheath. The flap, based on the deep inferior epigastric artery, is raised and sutured to the duodenal fistula with thick silk sutures. Rectus muscle from either side can be used; it is important to take extra care not to injure the vascular pedicle of the muscle while raising the flap, as damage may compromise the vascularity of the muscle, leading to necrosis. Three silk sutures were taken through the muscle and edges of the duodenal fistula and brought out through muscle again in a U- shaped manner. The sutures were tied on the rectus muscle without tension so as to avoid cutting through the tissues. A few more reinforcement sutures were placed between the periphery of the muscle and the duodenum. The sutures were placed away from the vascular pedicle of the muscle flap (fig11). The abdomen was partially closed after adequate external tube drainage was established. Regular limited peritoneal

lavage with normal saline was carried out through that opening **(Chander et al, 2004).**



(Fig. 11)

1. U-shaped silk sutures being taken through the mobilized rectus abdominis muscle and the duodenal fistula.

2. The complete repair with the rectus abdominis muscle showing silk sutures and additional reinforcement sutures placed toward the periphery of the muscle **(Chander et al, 2004).**

Definitive Surgical Management of Radiation enteritis:

Increasing use of radiotherapy for the treatment of gynaecological, rectal, and genito-urinary malignancies has led to more patients presenting with radiation enteritis. This condition is characterized by an obliterative vasculitis and a reduction in the number of actively dividing cells. This may give rise to stricture formation and intestinal fistulation, usually entero-enteral **(Slade and Scott, 2005).**

However, previously irradiated bowel may present specific problems and may be better treated with stricturoplasty. Microvascular thrombosis and fibrosis

associated with radiation therapy may result in an inadequate blood supply to the bowel wall to support healing anastomosis. Bypassing the fistula containing bowel segment rarely achieves closure and further surgery is often required after the bypass. In contrast, fistula bypass, while providing a route for gastric drainage such as gastrojejunostomy, is the preferred option for the surgical treatment of duodenal fistulae **(Chung et al., 1996).**

The prognosis for radiation fistulae is poor; they rarely close with conservative management and the only effective strategies for treating them are surgical associated with significant morbidity and mortality. Constructing a proximal loop stoma to the fistula is the simplest and safest strategy in poor-risk patients. If resection of the diseased segment and anastomosis is to be attempted, it must involve bowel which has been spared from the radiation field. Postoperative death, permanent stomas, intestinal failure, refistulation and infra-abdominal sepsis are seen frequently **(Slade and Scott, 2005).**

Definitive surgical management of Enterocutaneous fistulae:

The most common indication for definitive operative treatment is persistent drainage from the fistula. A number of factors are associated with failure of a fistula to close: irradiated intestine, Crohn's disease, presence of a foreign body, carcinoma, and lack of intestinal continuity, distal intestinal obstruction, or epithelialization of the fistula tract.

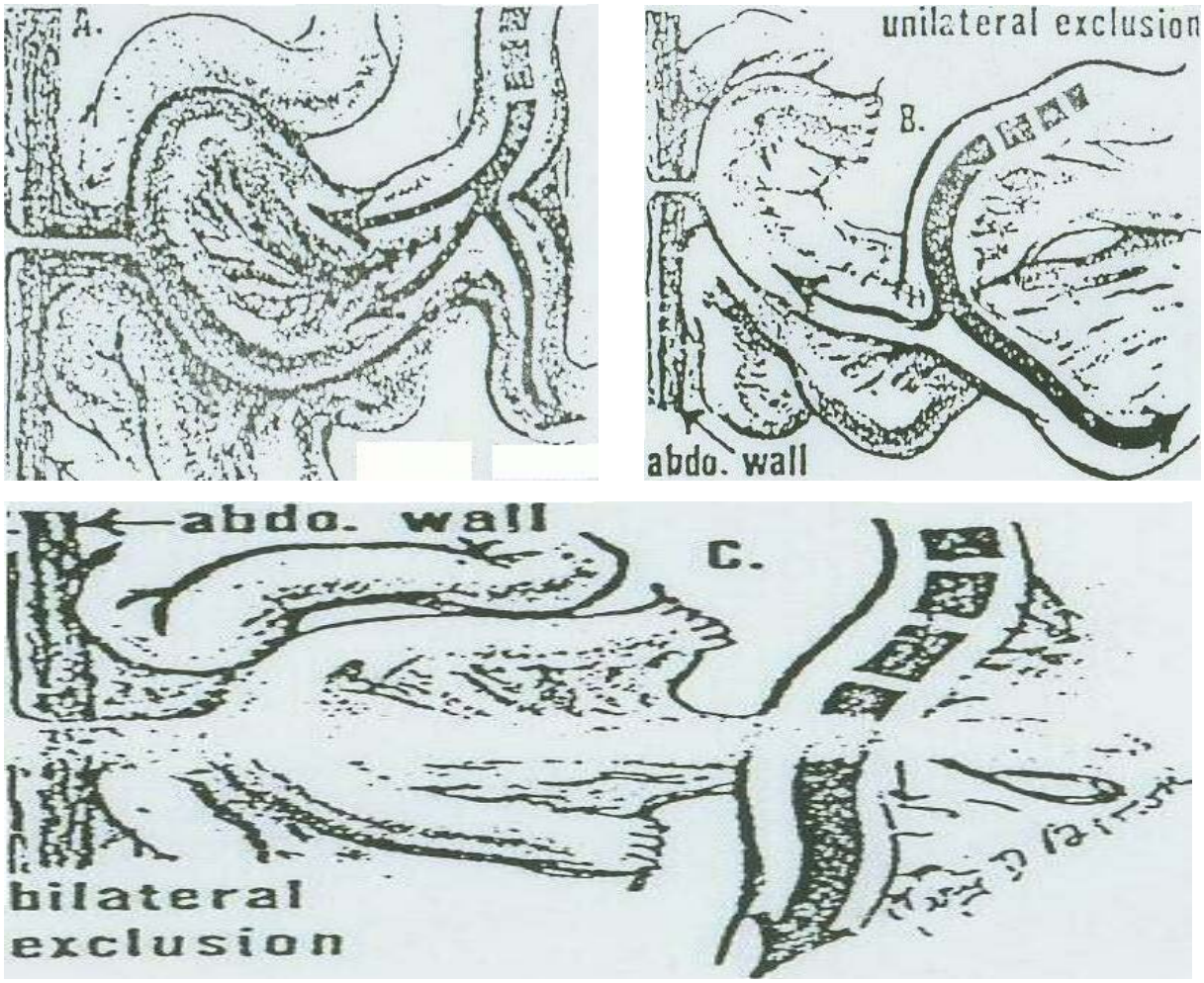
Resection with end to end anastomosis is the recommended management of the bowel loop containing fistula. This provides the permanent solution. When it is unsafe to resect the fistula containing the bowel segment, or if anastomosis would be unwise due to sepsis, malignancy, or previously irradiated bowel, resection with ostomy formation or exteriorization of the two bowel ends can be

carried out, it is critical that the proximal end be constructed exactly as a standard everted Brooke ileostomy so that a proper appliance can be applied **(Apostolos et al., 1996).**

If the fistula is not deemed appropriate for resection, as when it develops as a complication of a deep pelvic procedure, indirect approaches can be considered. Various bypass procedures have been proposed **(Soeters et al., 1989).**

A simple side-to-side anastomosis of the intestine proximal and distal to the fistula usually is inadequate as a bypass. Unilateral exclusion is also inadequate for diversion most of the time(fig 12). Bilateral exclusion is necessary for effective defunctionalization of a fistula. This can be the first phase of a staged approach. Initially, the fistula is left undisturbed and the afferent and efferent loops are divided and an anastomosis is performed excluding the involved segment. The ends of the fistulous segment are closed or exteriorized as a mucus fistula. The fistulous segment then can be removed at a later date. Alternatively, if the efferent loop cannot be mobilized, the intestine proximal to a distal ileal fistula can be divided and anastomosed to the transverse colon (Large, 1998).

The segment of intestine leading to the fistula can be exteriorized as a mucous fistula or may be over sewn and returned to the pelvis. This is not as satisfactory as complete exclusion, but works reasonably well if the ileocecal valve is competent. In most instances, optimum management should include removal of the fistulous segment as a second procedure **(Soeters et al., 1989).**

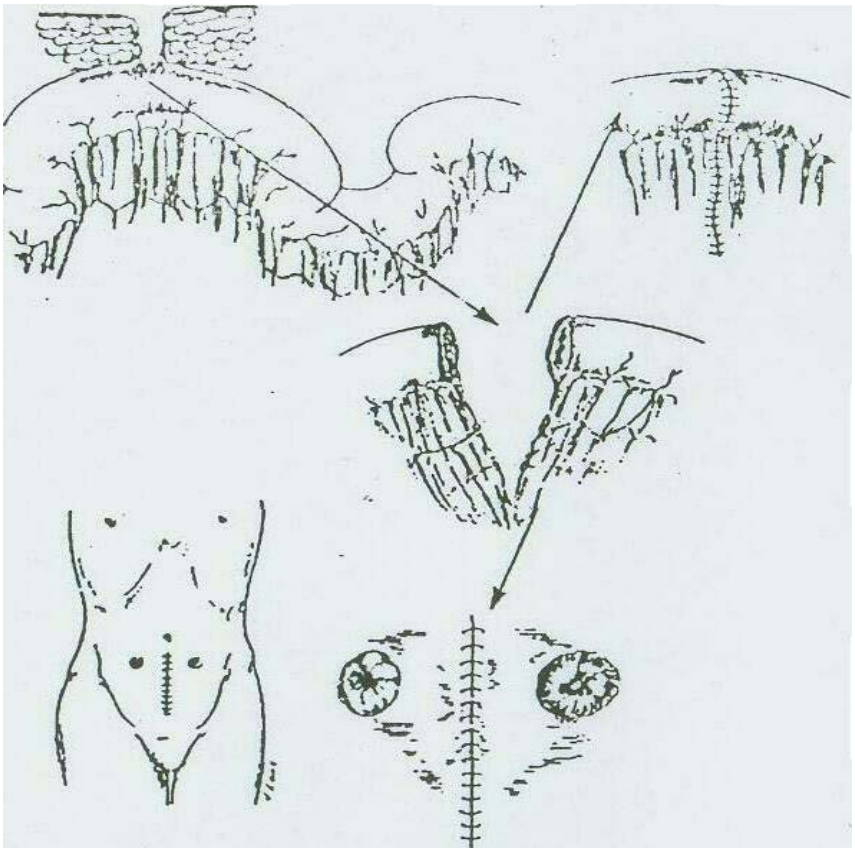


(Rolando and Joel, 1996)

Fig. (12): Methods for bypass and exclusion of small intestinal fistula

Because reoperation is usually necessary following the bypass, there is no benefit to using this procedures rather than exteriorization or ostomy formation (fig. 13) **(Soeters et al., 1989).**

Direct suture closure of the fistula should not be performed, as it is associated with a high incidence of breakdown and fistula recurrence **(Scott and Josef, 1996).**



(Fig. 13): Small intestinal fistula management. **Above**: Small intestinal fistulae are best managed by resection with end-to- end anastomosis. **Below:** when unsafe to perform a primary anastomosis the ends can be exteriorized as end ostomies with anastomosis done when the patient is stable. The proximal effluent could be reefed into the distal ostomy **(Scott and Josef, 1996).**

Definitive surgical management of Enteroenteric fistulae:

The operative procedure of choice is en bloc resection of the diseased intestine in continuity with the fistula tract. In 100 patients managed surgically by Petit and Irving over a 12 years period, a 96% closure rate was obtained with only a 1 % mortality reported. If inflammation or an abscess is present, primary resection may be unwise. In such situations, total proximal diversion is necessary. Drainage of any associated abscess cavity is essential. Resection of the diseased intestine and fistula should be delayed for at least 6 weeks, if

possible to allow the inflammatory process to subside **(Petit and Irving, 1988).**

Definitive surgical management of necrotizing pancreatitis:

Gastrointestinal fistulae arise on a background of necrotising pancreatitis either directly through damage to the distal pancreatic duct with associated proximal stricture formations or through deliberate attempts to drain a pseudocyst percutaneously or transgastricly .collateral damage to small bowel with subsequent fistula formation may also follow multiple pancreatic necrosectomies. Surgical resolution may at times only be achieved by fistula drainage into a jejunal Roux loop **(Slade and Scott, 2005).**

Approach to the treatment of intestinal fistula in the inaccessible abdomen: Transbursal end-to-side duodenogastrostomy:

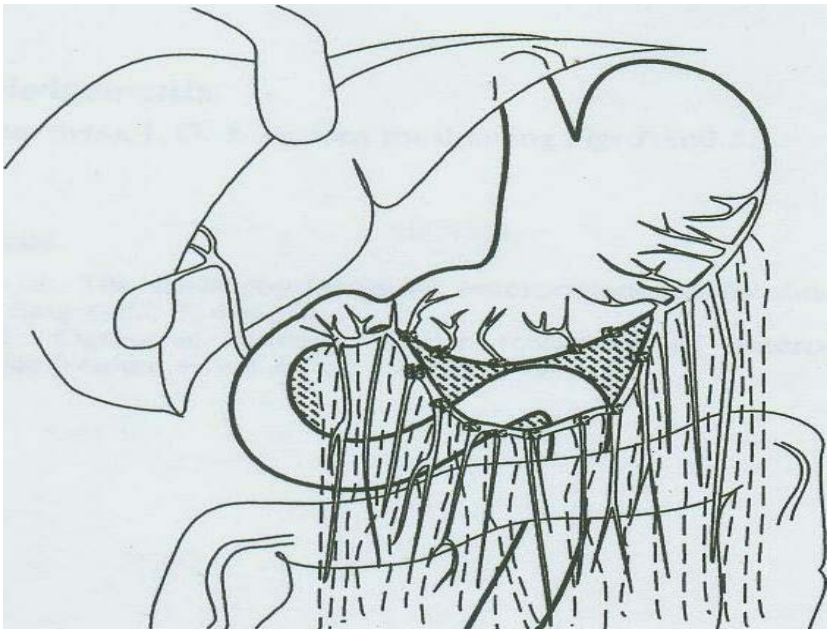
Most enterocutaneous fistulae occur as a result of dehiscence of suture lines or from surgical trauma during re-exploration for severe intra-abdominal infection. Traditional surgical treatment of persisting entero- cutaneous fistula consists of diversion of intestinal effluents away from the defect by exteriorization of the digestive tract proximally to the defect, or by exteriorization of the defect itself **(Rubelowsky et al., 1991).**

However, exteriorization of the digestive tract is nearly always impossible when the abdomen has become inaccessible. Re-exploration under these circumstances frequently leads to the occurrence of even more leaks **(Schein et al., 1990).**

It is for these uncommon but, when left untreated, usually fatal situations that a rather radical but surprisingly effective solution has been devised: total disconnection of the proximal digestive tract through the bursa omentalis, which is nearly always surgically untouched and is generally not disturbed by the intra-abdominal infection **(Bosscha et al., 1998).**

The basic principle behind the technique of total disconnection of the proximal digestive tract is the observation that in a completely scarred and adhesive abdomen, and even in the presence of enterocutaneous fistula and intra-abdominal abscess, the bursa omentalis remains virgin territory with an undisturbed anatomy and proper surgical dissection planes **(Bosscha et al., 1998).**

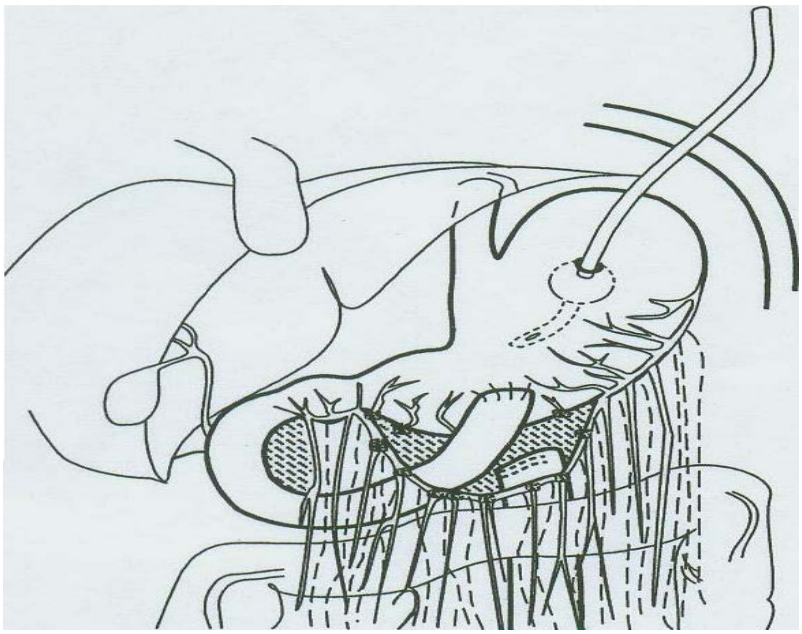
Through a small, 6-8-cm long, median incision just below the xiphoid, the upper part of the abdomen is opened. Immediately below this incision the left lobe of the liver and the stomach are identified. The lesser sac (bursa omentalis) is then opened by dividing 5-10 cm of the gastrocolic ligament along the greater curvature of the stomach (Fig.14). Near the caudal edge of the pancreas the transverse mesocolon is incised just left of the aorta and the ascending duodenum and duodenojejunal flexure are identified and carefully mobilized. By transecting the ascending duodenum and closing the distal end by means of a GIA stapler, total disconnection of the proximal digestive tract is achieved. An end-to-side duodenogastrostomy is subsequently performed and a tube gastrostomy is added for decompression (Fig. 15).



(Bosscha et al., 1998)

(Fig. 14)

Opening of the bursa omentalis by dividing 5-10 cm of the gastrocolic ligament along the greater curvature of the stomach



(Bosscha et al., 1998)

(Fig. 15)

Total disconnection of the proximal digestive tract by means of an end-to-side duodenogastrostomy and a tube gastrostomy for decompression

After total disconnection of the proximal digestive tract, output of all fistulae stopped promptly and almost completely (except for the production of mucus), and skin irritation healed. All patients recovered quickly from intra-abdominal sepsis and were transferred temporarily to the outside hospital for further convalescence. No operation-specific complications were encountered. Minor electrolyte disturbances were occasionally seen and could be easily corrected by supplements to the intravenous feeding **(Bosscha et al., 1998).**

Laparoscopic Treatment of Intestinal Fistulae:

Laparoscopic bowel resection for benign disease has become more common since it was first performed in early 1990s (Jacobs et al., 1991). The reported advantages include decreased pain, faster return of bowel function and resumption of diet, shorter length of stay, faster return to normal activity, and improved cosmosis. Laparoscopically assisted sigmoid coloctomy for diverticular disease and ileocolic resection for Crohn's disease are becoming more routinely at many centers However, conversion to open and traditional open procedures have been more common when a significant inflammatory reaction with accompanying abscess or fistula occurs **(Poulin et al., 2000).**

Recurrent disease requiring reoperation can also be successfully treated using laparoscopic methods **(Watanabe et al., 2002).**

Fistuloscopy -an adjuvant technique for sealing gastrointestinal fistulae:

Endoscopic occlusion of gastrointestinal fistulae can be successfully achieved in a high percentage of patients. In cases where the intestinal opening of the fistula is not accessible, such treatment was hitherto impracticable.

Fistuloscopy is a new technique which (fig. 16), using a flexible endoscope advanced percutaneously along the fistula tract to seal these gastrointestinal fistulae. The complications were all caused by fibrin glue injection into the fistulae under pressure. Provided that elevation of the air pressure in the fistula system is strictly avoided, fistuloscopy is a safe and potent method of occluding gastrointestinal fistulae, which otherwise need prolonged conservative treatment or hazardous surgical intervention **(Lange et al., 1989).**

Agents used for sealing:

Polidocanol, Prolamin, Fibrin glue, Fibrin glue combined with Polidocanol/prolamin **(Lange et al., 1989).**

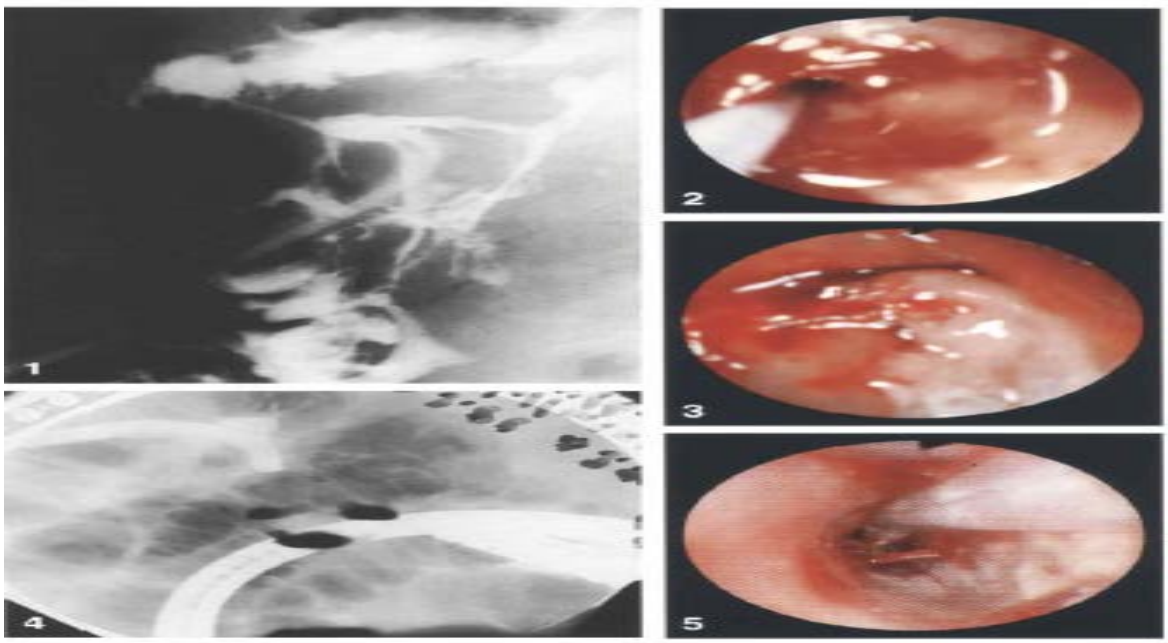


Fig. 16

1-Fluoroscopic view of a branched peripancreatic fistula connecting the partially resected stomach, left colon and skin, 2-Small gastric anastomotic leak, 3-Defect in 2 occluded by a fibrin clot, 4-Fluoroscopic examination of fistuloscopic advanced bronchoscope. The colonoscope is close to the fistula opening in the colon, 5-Fistuloscopy; spray catheter visible **(Lange et al., 1989).**

CHAPTER VI

MANAGEMENT OF COMPLICATION

Cutaneous protection:

The effects of continuous moisture and enzymic irritation can severely compromise skin integrity and lead to infection and delayed wound healing. In addition to protection of the perifistula area, effectively containing the discharge allows accurate measurement of fluid and electrolyte losses and thus enables timely replacement and maintenance of nutritional balance **(Ge-Fei Wang et al., 2004).**

Provision of optimal skin care may be achieved through assessment of the following four criteria: origin of the fistula, nature of the effluent, condition of the skin, and location of the tract opening **(Ge-Fei Wang et al., 2004).**

An output volume of 500 ml/24 hours is usually contained within a pouch system while an output of 50 ml/24 hours may be contained with a dressing and skin barrier. Thick effluent is best contained within a drainable-type pouch while liquid effluent is usually contained using a urostomy-type pouch with a spigot-type closure that may be connected to a larger drainage system. Additional use of a durable skin barrier is required when the effluent has a high proteolytic content or is either excessively acid or alkaline. The method of containment is also dependent on the condition of the skin surrounding the wound and the location of the fistula tract opening. Severe ulceration and infection create a moist non-adherent surface that causes considerable difficulties with pouch and barrier methods. Furthermore, multiple openings, openings within deep skin folds, on bony prominences, sutures, or open wounds all affect the protection required, as do differences in the contours of the skin around the fistula between the supine and upright position **(Ge-Fei Wang et al., 2004).**

Wound care and antibacterial therapy:

Regardless of the cause, leakage of intestinal juices often leads to localised and systemic sepsis. Patients with gastrointestinal fistulae are prone to a range of infections, such as sepsis from intravenous catheters, phlebitis, pneumonia, and urinary tract infections, although infections of the surgical wound and the abdominal cavity are most common (Rolandelli et al., 1996). Septic foci may not only contribute to the formation of an enterocutaneous fistula but may also reduce the likelihood of spontaneous closure **(Fazio et al., 1983).**

Infection of the wound following Whipple's procedure occurs in approximately 5–20% of patients. Management measures include removal of sutures or staples in infected areas, with drainage, packing, and antibiotic therapy as appropriate. Preoperative prophylaxis with suitable antibiotics is recommending—for example, bowel preparation with neomycin and erythromycin—and perioperative administration of an intravenous first or second generation cephalosporin **(Yeo C.J., 1995).**

Gastrointestinal fistulae can also be associated with serious abdominal wall infections. The combination of bacterial infection and caustic erosion from digestive enzymes can result in rapid spread of the infectious process through fascial planes, subcutaneous tissue, and muscle, leading to necrotising fasciitis and gas gangrene. Infections of this nature are potentially life threatening and require aggressive management measures such as surgical incision and drainage, debridement, and appropriate antibiotic therapy **(Rolandelli et al., 1996).**

Good stoma care is therefore vital in patients with gastrointestinal fistulae. Teaching patients practical skills in stoma care not only deals with problems such as leakage from the pouch or sore skins but also the patient's psychological adaptation following stoma surgery **(Gonzalez and Moreno, 2001).**

Incidence, bacterial spectrum and drug sensitivity of catheter-related infection (CRI) in gastrointestinal fistula patients:

Catheter-related infection is still the common complication during total parenteral nutrition (TPN) treatment in patients with gastrointestinal fistulae, and Gram-negative bacteria are the main pathogens, and bacterial translocation is considered the common reason for **CRI (Ge-Fei Wang et al., 2004).**
Gram-positive bacteria like S. epidermidis and S. aureus were most frequently cultivated from catheters **(Reimund et al., 2002).**

Bacterial skin colonization at the catheter-skin interface at the time of insertion or afterward distal spread of the bacteria along the external catheter surface is the basic pathogenesis. However, Gram-negative bacteria are the most common organisms causing CRI of gastrointestinal fistula patients, and the orderly are Gram-positive bacteria and Fungi. Three reasons were considered for this phenomenon. First, the importance of catheter nursing has been recognized and the means for decreasing bacterial skin colonization, such as disinfection and dressing replacement were performed several times per week. Second, gastrointestinal fistula patients always were complicated with inflammation of abdomen, microorganisms especial Gram-negative bacteria could broadcast from abdominal abscess to blood and adhere to catheter-hub and colonize. Third, patient was commonly fasting once gastrointestinal fistula occurred.

Long-term lack of food stimulation and direct lumen nutrition, mucous atrophy, height of villus decrease, barrier damage arise, followed by bacterial translocation from gastrointestinal tract to the mesenteric lymph nodes even blood **(Odetola et al., 2003).**

Gram-negative bacterial translocation was considered to be the most common reason for the high incidence of CRI in gastrointestinal fistula patients.

Several researches indicated that gut bacterial translocation might be the pathogenesis of catheter-related infection during TPN.

Candida sepsis during TPN might be the result of Candida translocation from the gut due to the combination of high-density candida colonization and favorable local conditions in the gut induced by TPN and bowel rest **(Pappo et al., 1994).**

Patients with an extremely short remaining small bowel (shorter than 50 cm) receiving home TPN had a higher frequency of catheter-related sepsis, particularly by enteric microorganisms **(Terra et al., 2000).**

Absence of gastrointestinal integrality and extravasations of intestinal succus would induce abdominal or systemic infection once fistula occurs, and the best treatment to deal with fistulae and infection is more effective drainage. Without effective drainage, it is very difficult to control infection, even with antibiotics from low to high grade or narrow to broad spectrum. Abuse of antibiotic would result in arouse increase of drug resistance. Drug resistance of gastrointestinal fistula patients is high, and the preferably sensitive antibiotics for Gram-negative bacteria were imipenem, ceftazidime and cefoperazone/sulbactam, and those for Gram-positive bacteria were vancomycin, norfloxacin and ciprofloxacin **(Ge-Fei Wang et al., 2004).**

Prevention and treatment of catheter-related infection:

The methods for prevention of CRI included skin cleanout and antisepsis before catheter inserted, strictly disinfection system and operation during inserting, catheter nursing and dressing replacement after insertion, decreasing manipulation of catheter, and avoiding unnecessary device **(Rijnders et al., 2003).**

Catheters must be removed once CRI occurred or clinically suspected to be, subsequently therapies of experiential antibiotics were supposed to utilize, though part of patients could self-cure without treatment of any antibiotics **(Harbarth et al., 2003).**

Imipenem, ceftazidime and cefoperazone/sulbactam are the perfect choice for therapy of experiential antibiotics based on the result of drug sensitivity. If the infective symptom persisted after catheters were removed and antibiotics were utilized, drug resistance or Candida infection should be considered, and effective antibiotics or antifungal drugs should apply according to drug sensitivity. Intravenous glutamine or short-chain fatty acids could reduce central venous catheter related infection by reducing bacterial translocation from gut lumen **(Ding LA et al., 2003).**

According to the advancement of gastrointestinal physiology, enteral nutrition has been confirmed to improve gut mucosa barrier and liver function and nutrition, reduce bacterial translocation and avoid infection complication of TPN **(Fatkenheuer et al., 2003).**

Fluid/electrolyte replacement:

Gastrointestinal fistula exudate is typically comprised of a rich mixture of sodium, potassium, chloride, and bicarbonate ions, proteins, and other components. Large volumes of gastrointestinal secretions may be lost through fistulae which potentially result in profound disturbances in fluid and electrolyte levels leading to dehydration, hyponatraemia, hypokalaemia, and metabolic acidosis. The degree of the deficit caused by the fistula is directly proportional to volume and composition. To assess fluid and electrolyte requirements, the

volume and content of the exudate should be analysed. It is important to note that the composition of the exudate cannot be assumed to correspond with the normal composition for the anatomical position of the fistula. Discharge from the fistula may be a mixture of fluid proximal and distal to the anatomical site of the tract **(Foster and Lefore 1996).**

Blood transfusions may also be required as most patients with fistulae have reticulopenic anaemia, in common with chronic illness **(Adotey, 1995).**

Fistula losses from patients with pancreatic fistulae are especially hypertonic and rich in bicarbonate and protein. However, sodium content is comparable with serum concentration and therefore saline with supplemented bicarbonate may be used for replacement. The composition of the output from pancreatic fistulae is dependent on the rate of pancreatic secretion, stimulated by oral intake, gastric distension, and cholecystokinin. As a consequence, elimination of oral intake and substitution of alternative nutrition is an important early step in the stabilisation of fistula patients **(Gonzalez and Moreno, 2001).**

Nutritional support and bowel rest:

Malnutrition is closely associated with the site and output of a fistula and is a major concern in patients with enterocutaneous upper gastrointestinal fistulae. In particular, hypoproteinaemia leads to delayed gastric emptying and prolonged ileus, increased frequency of wound dehiscence, greater risk of infection, and decreased muscle bulk and function. In addition, fibroblast activity is reduced; delaying wound healing and causing failure of scar contracture. Patients are frequently malnourished prior to the development of the fistula and indeed malnutrition may increase the risk of fistula formation and greatly increase the required healing time **(Campos et al., 1996).**

A further important consideration of inadequate nutrition is a decrease in amino acid precursor availability for major brain neurotransmitters. Malnutrition can frequently lead to a state of mental dullness, depression, and apathy, which will have a considerable negative impact on the patient. As complication rates are higher in malnourished patients, nutritional support should be initiated as early as possible in the management of patients with gastrointestinal fistulae (Meguid et al., 1993).

There are three potential mechanisms through which a fistula may induce malnutrition: lack of food intake, loss of protein and energy rich fluid in fistula discharge, and hypercatabolism associated with sepsis **(Fischer, 1986)**

Oral food intake in such patients will be limited for obvious reasons and should be totally discontinued where gastric, duodenal, pancreatic, or small bowel fistulae are suspected. The presence of nutrients in the gut, especially solid food, stimulates secretion of digestive juices and therefore increases fistula output, exacerbating poor nutritional status and limiting healing. Small bowel secretions can lead to daily losses of approximately 75 g of protein and approximately 12 g of nitrogen, comprised of desquamated cells, plus pancreatic exocrine, biliary, succus entericus, and gastric secretions **(Fischer, 1986).**

Under normal circumstances the majority of this nitrogenous material is reabsorbed as free amino acids but in high output upper gastrointestinal fistulae much of this protein is lost. In addition, surgical trauma can induce complex physiological changes that lead to catabolism and loss of body cell mass. This reaction may be exacerbated by previous malnutrition and postoperative complications **(Waitzberg, 1999).**

In general, patients with low output fistulae should receive the full basal

energy requirement and between 1 and 1.5 g of protein per kg body weight every day, with a minimum of 30% of the caloric intake supplied as lipid. With high output fistulae, patients should receive 1.5–2 times their basal energy expenditure plus 1.5–2.5 g of protein per kg body weight per day. This nutritional regimen should also include twice the recommended daily allowance (RDA) for vitamins and trace minerals, up to 10 times the RDA for vitamin C, and zinc supplements **(Berry and Fischer 1996).**

Fistulae from the small intestine that have been established for a number of weeks are often associated with considerable zinc and copper deficiency, and patients may also be deficient in folic acid and vitamin B_{12} **(Koruda et al., 1992).**

Nutrient Requirements of patients with gastrointestinal fistula:

1- Water and Electrolyte Requirements:

Of the different schemes devised to calculate maintenance fluid needs, water requirement based on caloric expenditure (1 mL/kcal/24 hour) is the most practical because, in general, 1mL of water is needed for each calorie expended. Factors that significantly increase water and energy needs include loss of gastrointestinal fluids, fever, and sepsis. Additional losses caused by external gastrointestinal and fluid losses must be accurately measured and analyzed for major electrolyte content. The electrolyte content of the replacement fluids must consequently be adjusted accordingly **(Hollington et al., 2004).**

Withholding sodium, potassium, or phosphorus from TPN prevents anabolic retention of the remaining elements, including nitrogen, thereby making their inclusion essential **(Hollington et al., 2004).**

2- Energy and Nitrogen Needs:

Energy derived from enteral or parenteral nutrients must include the caloric cost of several factors, including (1) resting energy requirements (5% to 10% greater than basal requirement), (2) increased energy requirements secondary to illness (stress factor), and (3) energy for physical activity (activity factor) **(Micheal et al, 1996).**

In clinical practice and in the absence of sophisticated techniques for measuring energy requirements, 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 adult men and women.

For men: BME (kcal/d) =66.4730+13.7516 (W) + 5.0033 (H)-6.755 (A)

For Women: BME (kcal/d) =655.095+9.563 (W) + 1.8596 (H)-4.6756 (A).

(Micheal et al., 1996)

Maximum oxidation of the infused glucose is approximately 15g/hr. At higher infusion levels carbon dioxide production is increased and fat synthesis is stimulated. Excessive exogenous glucose infusions embarrass both respiratory and hepatic functions in severely stressed patients. Studies comparing the protein-sparing effect of exogenous glucose and fat calories indicate that in injured and highly stressed patients, only glucose significantly suppresses gluconeogenesis **(Micheal et al., 1996)**

Hence, parentral glucose should constitute the major caloric source in TPN and the rest of the calories should come from fat. Its use also meets the need for essential fatty acid requirements. Glucose and fat calories are interchangeable in most patients with gastrointestinal fistulae. Thus, the addition

of fat to glucose TPN, as in the currently used three-in-one system, can achieve effective protein-sparing and anabolism **(Macfie et al., 1981).**

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. Amino acids or protein hydrolysates administered enterally have an effect similar to that observed when given parenterally. It is recommended that 1.0 to 1.2 g/kg/day should be given for maintenance, 3.5 to 2.0 g/kg/day should be prescribed for repletion, and 2.0 to 2.5g/kg/day should be given to patients with excess losses **(Michael et al., 1996).**

3- Calorie-to-Nitrogen Ratio:

Using a TPN formula with a Calorie: Nitrogen ratio of 1:150, which provides 1.75 times the Harris-Benedict estimation of caloric expenditure, optimal nitrogen balance is produced in a large group of malnourished patients. Nitrogen balance studies and tracer kinetic studies show that receiving 35 to 40 kcal/kg/day and 0.2 to 0.3 g/kg/day of nitrogen leads to positive nitrogen balance in a large number of patients undergoing operation for gastrointestinal cancer. This represents a Calorie: Nitrogen ratio ranging from 200:1 to 130:1 **(Michael et al., 1996).**

4-Vitamins and Trace Elements:

The recommended daily maintenance doses for vitamins and trace elements parenteral requirements are at least as great as the oral requirements. Few data on their specific requirements for a variety of disease states, such as gastrointestinal fistula, exist for patients receiving TPN **(Michael et al., 1996).**

This nutritional regimen should include twice the recommended daily allowance (RDA) for vitamins and trace minerals, up to 10 times the RDA for vitamin C, and zinc supplements. Fistulae from the small intestine that have been established for a number of weeks are often associated with considerable zinc and copper deficiency, and patients may also be deficient in folic acid and vitamin B12 (**Gonzalez and Moreno,2001).**

CHAPTER VII

FACTORS AFFECTING THE OUTCOME IN PATIENTS WITH SMALL INTESTINAL FISTULAE

Introduction:

There is great variability in the mortality rates of gastrointestinal fistula patients due (in part) to the very heterogeneous nature of patients and their fistulae. Whereas some patients are well nourished and have a well-drained low-output fistula, others are in poor general and nutritional conditions, may be septic and dehydrated, and may present with complex abdominal wall defects or macerated skin. Comparison of mortality rates of patients with gastrointestinal fistulae is therefore difficult because many variables influence the results, including the organ of fistula origin, fistula output, inclusion of internal or only external fistulae, the percentage and degree of malnutrition of the population studied, the presence of sepsis, the diagnosis of inflammatory bowel disease or cancer, and the presence of complex abdominal wall defects. The presenting clinical picture influences the surgeon's decision whether to operate the patient early to ensure adequate drainage of the fistula or to perform an ancillary procedure such as a feeding jejunostomy or diverting colostomy. Conversely, the surgeon may decide to wait, with the expectation that the fistula will eventually close spontaneously with supportive treatment **(Kuvshinoff et al., 1993).**

Thus, an understanding of the factors that influence outcome concerning the likelihood of spontaneous fistula closure or the need for surgical intervention is of great value to the surgeon in the decision-making process **(Kuvshinoff et al., 1993).**

1. Local Fistula Characteristics:

Some local fistula characteristics are of prognostic importance, as they related to both spontaneous closure and mortality. These factors also influence the decision of the timing of operation, and include epithelialization of the

fistulous tract, eversion of mucosa, loss of intestinal continuity, presence of diseased bowel adjacent to the fistula, multiple fistulae; previous radiation therapy, presence of ileus, distal obstruction, and abdominal wall defects.

Although these local characteristics are of prognostic importance, their evaluation is subjective (table 10). The ideal approach would be to limit the analysis of prognostic factors to objective criteria only **(Gonzalez and Moreno, 2001).**

Table10 Anatomical factors predictive of spontaneous fistula closure

Unfavorable	Favorable
Complete disruption	Continuity maintained
Lateral fistula	End fistula
Large adjacent abscess	No associated abscess
Adjacent bowel diseased	Adjacent bowel healthy
Distal obstruction	Free distal flow
Fistula tract<2 cm with epithelialization	Fistula tract >2 cm — non-epithelialized
Enteral defect <1 cm	Enteral defect >1 cm
Fistula site:	Fistula site:
• Gastric	• Oropharyngeal
• Lateral duodenal	• Oesophageal
• Ligament of Treitz	• Duodenal stump
• Ileal	• Pancreatobiliary
	• Jejunal

(Gonzalez and Moreno, 2001)

2-Organ of Origin:

The fistula site is important to predict spontaneous closure and may also influence the mortality. Spontaneous closure is more frequent biliopancreatic fistulae. It occurs less commonly in duodeno jejunal fistulae. Spontaneous closure is more often in distal fistulae than in more proximal ones **(Hollender et al., 1983).**

The mortality in patients with gastrointestinal fistulae varies according to the origin of the fistula. Higher mortality is associated with duodenal or jejunoileal fistulae due to higher output, whereas in patients with low-output, the mortality is relatively lower (Levy et al., 1989).

3- Occurrence of Complications:

The occurrence of both septic and nonseptic complications greatly influences the percentage of spontaneous closure and the mortality. For example, in the study by Schein and Decker (1991), the overall mortality was 37%. However, in patients with fistulae draining through an evisceration or laparotomy, the mortality was 60%.

The presence of complications such as intra-abdominal abscess, sepsis, adult respiratory distress syndrome, upper digestive hemorrhage, renal or liver failure, and thromboembolism was associated with a mortality of 80%. When none of these complications was present, the mortality was only 4% **(Levy et al., 1989).**

Nutritional support-related complications, although potentially dangerous, usually do not influence the rate of spontaneous closure **(Antonio et al., 1996).**

The mortality of gastrointestinal fistula patients with sepsis is much higher than that of patients without associated sepsis. Antibiotics are useful to treat remote infection, such as urinary tract or respiratory infection, or as an adjuvant to surgical drainage. However, antibiotics are not useful in controlling intra-abdoimnal infections **(Malangoni et al., 1990)**

Non-septic complications such as acute myocardial infarction and pulmonary thromboembolism are occasionally seen in critically ill patients, such as those with gastrointestinal fistulae. Metabolic complications, although frequently seen, are seldom the cause of death. Frequent monitoring of blood glucose and electrolyte levels is essential to prevent such complications. This is especially important in high-output fistulae in which the losses of sodium, potassium, and bicarbonate are marked. Imbalances of serum magnesium, phosphorus, and zinc are also relatively frequent and must be adequately managed **(Berry and Fischer, 1994).**

4- Etiology:

The cause of the fistula influences both spontaneous closure and mortality. Acute postoperative fistulae have a higher mortality but are more likely to close spontaneously than a low-output ileal fistula associated with Crohn's disease, those fistulae that arise from radiation-damaged intestine or from malignant intestinal lesions are unlikely to close. Besides triggering malnutrition, malignant disease can cause immunosuppression and sepsis. For this reason, it is thought that associated malignant disease influences the cure rate of enterocutaneous fistulae. Those fistulae arising from bowel involved by inflammatory bowel disease often to close, only to reopen at a later date **(Gonzalez and Moreno, 2001).**

5- Age:

The age of the patient influences mortality but not spontaneous fistula closure. However, surgical closure is more often performed in younger patients. This may be due to the high mortality observed in older patients, which may be due to the presence co-morbidities and the reduced physiologic capacity of older patients to overcome the cumulative stresses associated with gastrointestinal fistula **(Antonio et al., 1996).**

6- Origin of the Patient:

The origin of the patient is also of prognostic significance. Referred patients from other institutions frequently arrive in poor general and nutritional conditions, and their mortality is higher. Usually, the mortality is lower and the rate of spontaneous closure is higher in patients operated primarily in the same hospital where the fistula is being treated. The explanation is that the well-drained low-output fistulae may be treated in smaller hospitals with minimal morbidity and mortality. However, patients with high-output complex fistulae are frequently transferred to tertiary hospitals, usually in poor general and nutritional condition **(Antonio et al., 1996).**

7- Fistula Output:

Fistula output greatly influences both mortality and spontaneous closure. The mortality was 54% and 16% for high and low-output fistulae. High-output fistulae are associated with a worse prognosis because of the greater fluid, electrolyte, and nutrient losses, which make management difficult. In some patients daily fistula output may exceed 2000 ml **(Gonzalez and Moreno, 2001).**

8- Serum Protein Level:

The serum albumin level, although not strictly related to the nutritional status, is of predictive importance in both medical and surgical patients. The level of serum albumin is considered an important predictive factor for both mortality and fistula closure. Low serum albumin is very common in gastrointestinal fistulae. no mortality in patients with serum albumin above 3.5 g/dl, whereas the mortality was 42% in patients with serum albumin below 2.5 g/dl **(Fazio et al., 1983).**

9-Role of transferring in predicting the outcome of patients with intestinal fistulae:

Serum transferring level was a strong factor influencing mortality and fistula closure. The explanation offered by the authors is that the muscle- gut-liver axis in these patients is more functional and that the stimulus from the small bowel is sufficient to increase hepatic protein synthesis, resulting in local synthesis of protein necessary for spontaneous fistula closure. The predictive value of transferring for spontaneous closure was not confirmed by other short turnover proteins, such as retinol-binding protein or thyroxin-binding prealbumin, although they were also predictive for mortality **(Kuvshinoff et al., 1993).**

10- Type of Nutritional support:

The type of nutritional support may also influence the results. Mortality rate has decreased with the advent of parenteral nutrition, but it is still higher in patients receiving parenteral nutrition than in patients on an oral diet. This apparent contradiction is explained by the fact that parenteral nutrition is administered to the most critical patients, usually with high-output duodenal and jejunoileal fistulae. Oral diet may be used in patients with low-output biliary or

colonic fistulae, in which mortality is usually low **(Antonio et al., 1996).**

11- Duration of the fistula:

The duration of the fistula influence both the likelihood of fistula closure and the mortality. Acute postoperative fistulae are more likely to close spontaneously than a chronic gastric or pancreatic fistula. However, the mortality is higher for acute than for chronic fistulae. The time elapsed between the causal event and the fistula onset has no prognostic significance. **Levy and his colleagues (1983)** reported a mortality of 47% in patients in whom the fistula appeared in less than 10 days and 43% in those appearing after 10 days, but this difference was not significant.

Factors affecting spontaneous closure:

Fistula closure is considered to be spontaneous if no surgical intervention is required although artificial nutrition and drug therapy may have been administered. Many factors may adversely affect spontaneous closure rates (table 11). The majority of adverse prognostic factors are anatomical, such as the presence of a distal obstruction, diseased adjacent bowel, or an associated abscess **(Ysebaert et al., 1994).**

Table (11) Factors that may adversely affect spontaneous closure rates

Anatomical	Other
• Discontinuity of bowel ends • Complete disruption • Distal obstruction (caused by an obstacle downstream or discontinuity between • Lateral fistula parts of the gastrointestinal tract • Intra-abdominal foreign body • Complex fistula • Associated abscess • Adjacent bowel diseased • Poor bowel vascularisation • Fistula tract <2 cm • Defect >1 cm • Epithelialization of mucocutaneous fistula tract • Drainage through large abdominal wall defect (multiple orifices • Internal fistulae • Fistula site (gastric, lateral duodenal, or ileal)	• Cancer • Chemotherapy • Radiotherapy • Underlying IBD • Uncontrolled sepsis, with or without abscess formation • Fistula fluid infected • Hypoproteinaemia • Large and early leakage of anastomosis • Diabetes patients • Corticosteroids • Renal failure • Output may prognosticate closure

(Berry et al., 1996)

Cancer, chemotherapy, and radiation are all thought to reduce the likelihood of spontaneous fistula closure (Martineau et al., 1996).

However, postoperative fistulae and those caused by appendicitis or diverticulitis are more likely to close spontaneously **(Berry et al., 1996).**

Clinical Outcome and Factors Predictive of Recurrence after Enterocutaneous Fistula Surgery:

Surgical repair technique was a significant predictor of ECF recurrence.

Etiology, age, duration of ECF, number of previous surgeries, preoperative and postoperative use of TPN, defunctioning stoma use, presence of undrained abscess, or physiologic parameters (serum albumin, total protein, white blood cell count, body mass index) did not influence recurrence rate by univariate or multivariate analysis (**Craig et al., 2005).**

It is important to note that, in some cases, a fistula may have been oversewn when it was not thought possible to perform a resection. This may have been because of an inability to adequately mobilize the bowel or concerns about the possibility of short bowel syndrome. If this is the situation, consideration should be given to protecting the repair with a proximal stoma or performing a bypass of that area **(Blackett et al., 1978).**

A low threshold is maintained for a defunctioning proximal stoma, particularly in the presence of residual sepsis, Crohn's disease, and radiation enteritis. If such a stoma is proximal in the jejunum, postoperative TPN will be required. The application of this management strategy, in the setting of an institution with access to multispecialty care, resulted in an acceptable level of success with ECF closure with a very low mortality and morbidity. It is applicable to ECF due to a variety of etiologies with similar success, including Crohn's disease (**Craig et al., 2005).**

CONCLUSION

Intestinal fistula is one of the most sophisticated problems which facing surgeons and needs extremely difficult decision-making and requires involvement of the patient, their relatives and a special team often in a specialized unit to produce a successful outcome. The decision to operate should be made after careful assessment of the patient's hospital course and in the context of the patient's disease process and current problem. It is essential, however, that the site and nature of the fistula be defined early and that any conditions likely to prevent spontaneous closure be identified. The presenting clinical picture influences the surgeon's decision whether to operate the patient early to ensure adequate drainage of the fistula or to perform an ancillary procedure such as a feeding jejunostomy or diverting colostomy. Conversely, the surgeon may decide to wait, with the expectation that the fistula will eventually close spontaneously with supportive treatment. Thus, an understanding of the factors that influence outcome concerning the likelihood of spontaneous fistula closure or the need for surgical intervention is of great value to the surgeon in the decision-making process.

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ملخص

ناصور الأمعاء عبارة عن وصلة بين تجويف جزئين من الأمعاء أو بين جزء من الأمعاء وجدار البطن الخارجي .

نواصير الأمعاء يمكن أن تكون خلقية ولكنها عادة ما تكون مكتسبة وقد تنتج عن مرض آخر بالقناة الهضمية أو تنتج عن تدخل في قناة هضمية سليمة .

يمكن أن تقسم النواصير إلى داخلية وخارجية والخارجية منها يمكن أن تصنف حسب كمية إفرازها اليومية ذات إفراز قليل أو متوسط أو كثير .

مرضى النواصير يعانون من مشاكل صحية يجب أن تكون في الحسبان عند علاج الناصور مثل تسرب مكونات الأمعاء والالتهابات الشديدة واختلال موازين الأملاح بالجسم .

كما يحدث مشاكل نفسية للمريض مثل إحساسه بأنه منبوذ والتي قد تؤدي إلى فقد الثقة في التدخل الجراحي .

التحكم في الالتهابات وضبط نسبة الأملاح بالجسم والعناية التامة بالجرح والتغذية السليمة يمكن أن تؤدي إلى تقليل معدل الوفاة وقد يساعد على التئام الناصور تلقائيا .

التدخل الجراحي يجب أن يكون في الوقت المناسب فالتدخل المبكر قد يؤدي للفشل كما أن التدخل الجراحي المتأخر قد يؤدي إلى مزيد من المضاعفات .

مضاعفات وعلاج نواصير الأمعاء الدقيقة

رسالة مقدمة

توطئة للحصول على درجة الماجستير في الجراحة العامة

مقدمة من

الطبيب / عبد العظيم على عبد العظيم على

بكالوريوس الطب والجراحة

تحت إشراف

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كلية الطب

جامعة عين شمس

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