The open abdomen

Part 3: Management of the Grade 3 open abdomen with entero-atmospheric fistulae

Pretorius JP, MBChB, MMed (Surg), FCS (SA); **Liebenberg C,** MBChB; Piek D, MBChB; **Smith M,** MBChB
University of Pretoria and Steve Biko Academic Hospital
Correspondence to: Prof Jan Pretorius, e-mail: jan.pretorius@up.ac.za
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Abstract

Entero-atmospheric fistulae are a disastrous complication when laparostomes have to be used in abdominal surgery. Patients must be approached from a global and localised perspective, with heavy focus on management of fluid balance, electrolytes, nutrition, and prevention of infective complications. Specialised dressing of the laparostome and fistulae is essential for optimisation of the patient's condition before undertaking more definitive forms of management, as well as for dignity and quality of life. Depending on the fistula classification, the dressing method may be successful. Fistula isolation is the key concept behind these specialised dressings. Ultimately, the objectives are to achieve either spontaneous or surgical closure of the fistula, and closure of the laparostome.

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Introduction

In recent years, the open abdomen has increasingly been making its way into the literature. It has been progressively used in practice as management of abdominal compartment syndrome. When an open abdomen is associated with an entero-atmospheric fistula, either de novo or as a later complication, it is classified as a Grade 3 open abdomen.[1] This is one of the most feared and frustrating complications of an open abdomen.

An open abdomen with an entero-atmospheric fistula is dreaded for many reasons. Firstly, where an entero-atmospheric fistula is present, control of effluent and contamination is challenging, and there is no standard protocol that successfully results in the containment of all fistulae and their effluent. Secondly, promoting closure of the fistula, either surgically or spontaneously, is an onerous undertaking. Thirdly, the patient's nutrition becomes exigent as enteral feeding may not be ideal, and parenteral feeding is often not sufficient, and not without its own complications. Lastly, the longer closure of the abdomen is delayed, the more challenging closure becomes, and the presence of fistulae delays closure significantly. In this article, we will share our opinions and findings with regard to the management of an open abdomen with an entero-atmospheric fistula.

Fistulae in the setting of the open abdomen

As stated previously, the open abdomen has featured more and more in the literature. However, the challenges of managing an entero-atmospheric fistula have not been receiving as much attention. Mostly, fistulae are dressed without successful control, and without separation of the fistulous effluent from the rest of the wound. This is a dire situation, as a wound bed and viscera bathed in bowel content has many complications (see Table I). Managing an entero-atmospheric fistula is far more difficult than managing a simple entero-cutaneous fistula, as control of effluent is considerably more problematic.

Table I: Anatomical classification of entero-atmospheric fistulae

Section of GIT[a] affected	Output
Oesophagus	Low
Stomach	High
Duodenum	High
Jejenum	High
Ileum	Moderate
Proximal colon	Moderate
Distal colon	Low

a = gastrointestinal tract

Causes of entero-atmospheric fistulae

Commonly, there are three origins of entero-atmospheric fistulae:

- The primary insult.
- Breakdown of anastomoses.
- Damage to and erosion of exposed viscera, due to lack of protection in the setting of an open abdomen.

There are many primary injuries that may result in entero-atmospheric fistulae, including perforation after obstruction, malignancy, peptic ulcer disease, diverticulitis and appendicitis.[1]

Breakdown of anastomoses may occur after previous bowel surgery. This may be either in a closed abdomen, typically requiring a relook laparotomy and likely a laparostome, or in an already open abdomen where anastomoses are known not to heal well.

Because of lack of protection, damage to and erosion of exposed viscera occurs frequently. Applying an appropriate dressing that is protective to the viscera has proved to be exceptionally difficult.

Classification of entero-atmospheric fistulae

For the purposes of this article, we have classified fistulae according to their anatomical (See Table I), positional (accessible vs. inaccessible) and structural characteristics (pouting vs. inverted).

Complications of entero-atmospheric fistulae

Complications of entero-atmospheric fistulae are perhaps best considered in the divisions shown in Table II.

Table II: Complications of entero-atmospheric fistulae

Systemic	Local	General
Fluid imbalance	Skin erosion	Poor patient hygiene, and physical and psychological discomfort
Electrolyte acid-base disturbances	Damage to viscera	Delayed closure of laparostome
Malnutrition	Localised fluid collections	More challenging dressings
Immunosuppression	Local sepsis	Greater difficulty in nursing care
Systemic sepsis	Mucosal atrophy	Prolonged hospital stay
		Increased cost

The systemic complications associated with entero-cutaneous fistulae are also seen with entero-atmospheric fistulae, but in general, these patients are much sicker and in a worse catabolic state, making disturbances more pronounced. The uncontrolled loss of effluent, which will have different content depending on the anatomical location of the fistula, may result in many of the systemic complications mentioned in Table II. The direct effects of spilled bowel content may result in the local complications mentioned in Table II. The chronicity and gross morbidity of the condition may have significant biopsychosocial effects, and lead to the other general complications mentioned in Table II.

Management of entero-atmospheric fistulae

Management can be subdivided into four areas of concern:

- Medical management and nutritional concerns.
- Dressing management of entero-atmospheric fistulae.
- Closure of entero-atmospheric fistulae.
- Closure of abdomen.

Medical management and nutritional concerns

Medical management is similar to the medical management of entero-cutaneous fistulae and entails the following:

Initial assessment and planning: Including a thorough history, and understanding the current condition and the circumstances surrounding its occurrence.

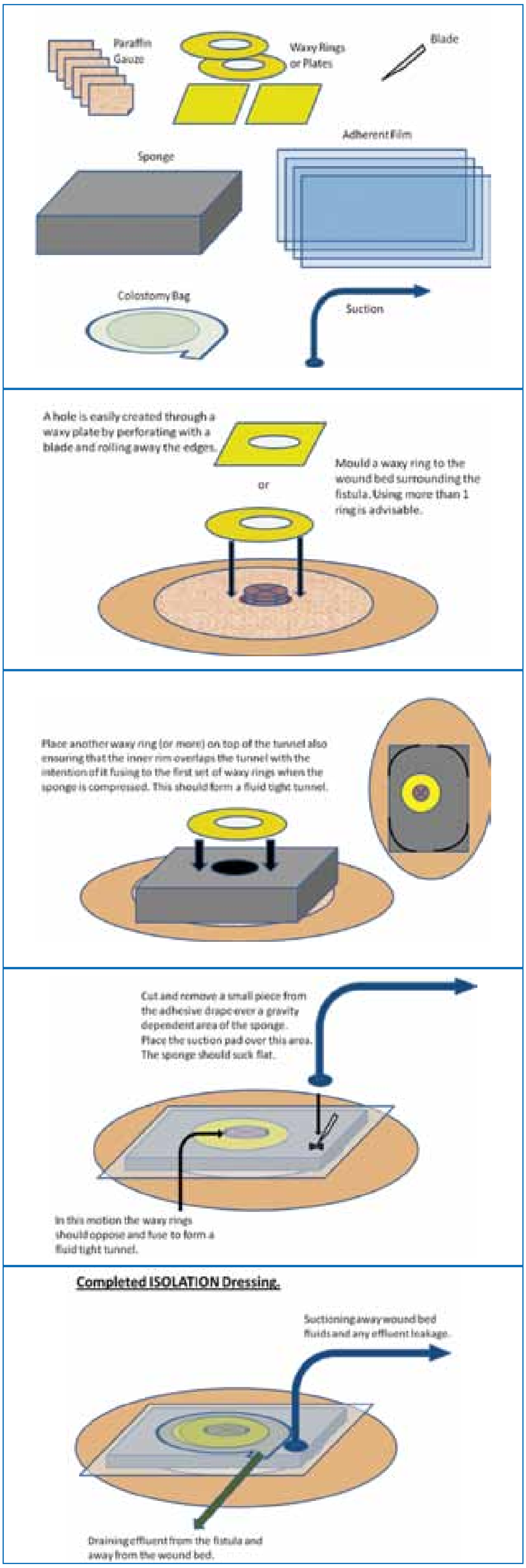
Managing electrolyte disturbances: Here, special care should be taken with low potassium and phosphate, as both are lost in high quantities in intestinal fluid (the actual amount varies with the position of the fistula). We suggest monitoring of the standard electrolyte profile and calcium, magnesium and phosphate levels daily.

Maintaining neutral fluid balances: Patients can lose litres of fluid through fistulae, and it is imperative to monitor intake and output closely (two to four hourly). We use a local standardised fluid protocol, shown in Table III.

Table III: Fluid therapy

	Maintenance	Replacement	Resuscitation
Amount of fluid	According to body weight.[a]	Start with 50% of losses (in this case from fistula) measured four hourly and replaced over subsequent four hours while collecting again. Adapt this in accordance with the volume of loss and patient hydration state (25%, 50%, 75% and 100%).	According to dynamic end-points of resuscitation.
Type of fluid	Enteral feeding if possible. Parenteral feeding if necessary. Balance made up by a fluid containing glucose and adequate daily need of electrolytes (e.g. 5% Maintelyte or Sustenance).	Determined by the fluid composition lost, e.g. Ringer's lactate is suitable for most gastrointestinal tract losses. More potassium may be needed if a proximal fistula is present.	For bleeding, replace with packed cells and fresh frozen plasma. For diarrhoea or vomiting, resuscitate with Ringer's lactate or Plasmalyte B.

a = We use this simple formula (but many others are available). For the first 10 kg, give 100 ml/kg, and for the next 10 kg, give 50 ml/kg. Thereafter, give 15 ml/kg if the patient is older than 50 years, and 20 ml/kg if the patient is younger than 50 years. Divide the total by 24 hours for an hourly rate. It is important to remember that the medication must be included in this total maintenance volume. Note that it is best to replace potassium when necessary during the day, rather than on a daily basis. Other electrolytes can be calculated daily.



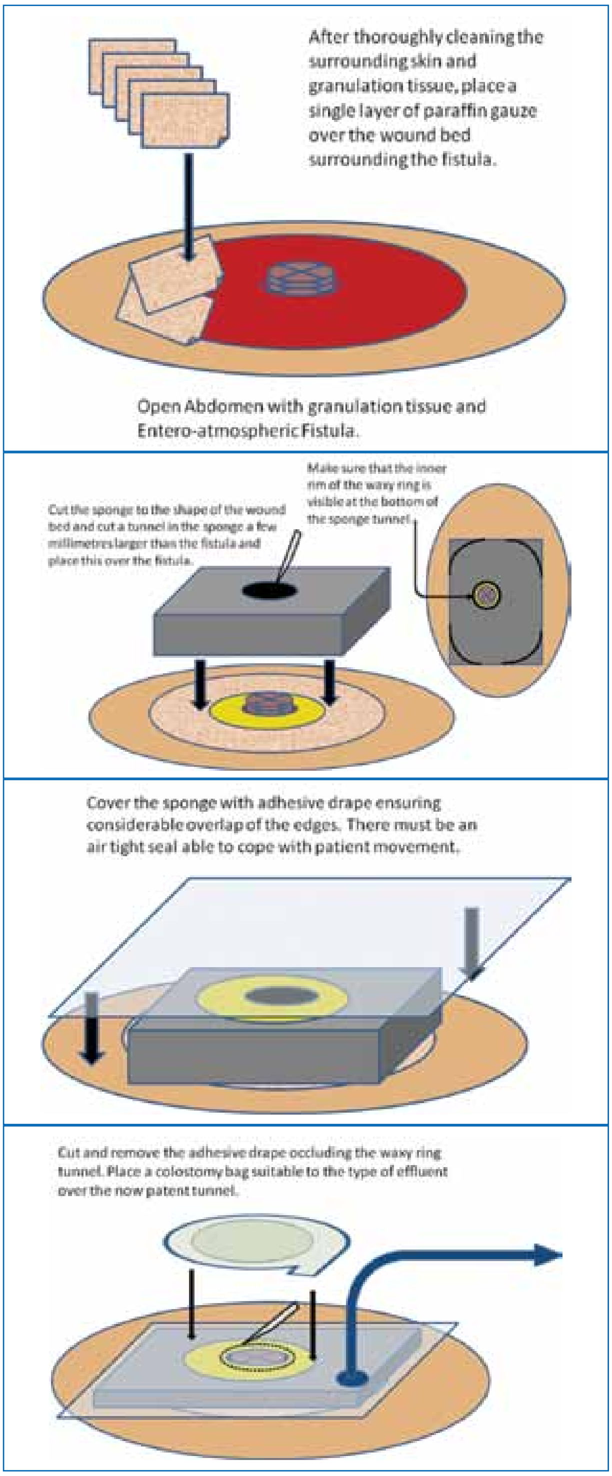


Figure 1: Recommended entero-atmospheric isolation dressing sequence

Case study

A 32-year-old-male, with a history of perforated appendix and acute abdomen, developed necrotising fasciitis of the right antero-lateral abdominal wall. The result was a central laparostome and debrided wound, complicated by an entero-atmospheric fistula in the region of the caecum (Figures 2a-2h).

Isolation scoring

We have treated several patients with laparostomes that have been complicated by entero-atmospheric fistulae in our critical care unit.

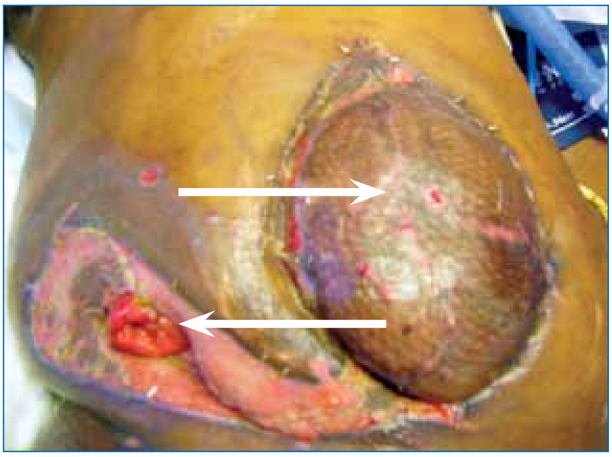


Figure 2a: Central, split skin grafted laparostome, with lateral visible, pouting, moderate output caecal entero-atmospheric fistula in granulated wound bed.

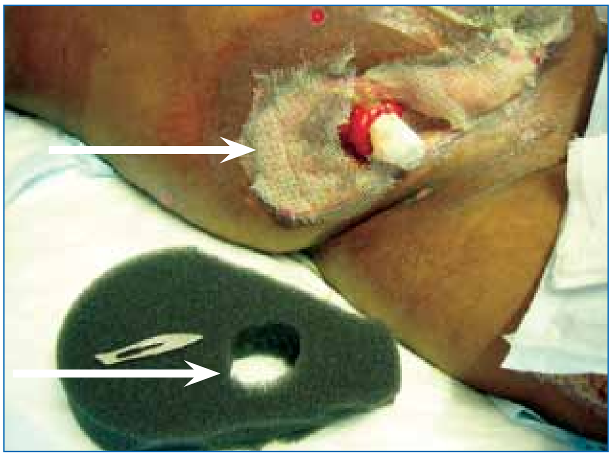


Figure 2b: Layered with paraffinated gauze. Fistula temporarily blocked with absorbent gauze. Sponge cut to shape, with port to serve as isolation tract for fistula.

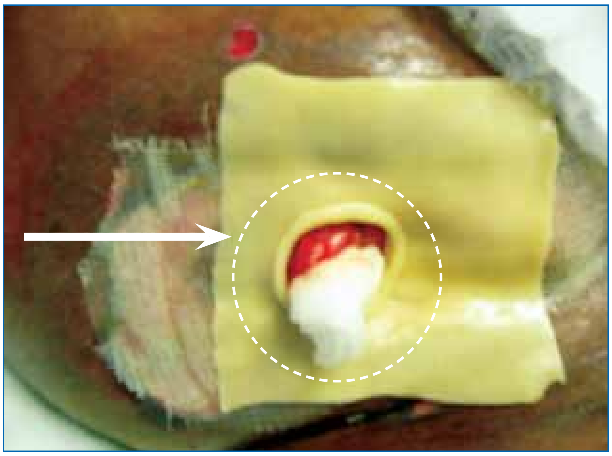


Figure 2c: Waxy plate moulded to wound bed, filling in corrugations and creating the tunnel foundation. Trimming as shown would be recommended.

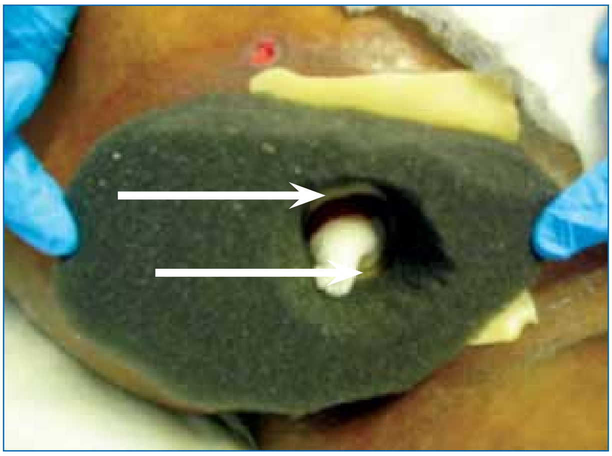


Figure 2d: Sponge placed appropriately on waxy plate, ensuring that a rim of waxy plate is visible within the sponge tunnel. A thicker rim than can be seen here is advisable, and can even be extended vertically into the tunnel.

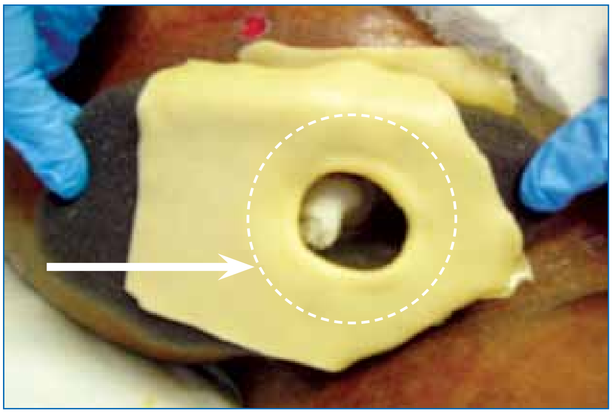


Figure 2e: A second waxy plate placed on top of sponge, also with a rim of waxy plate extending into the sponge tunnel. Again trimming as shown would be recommended.

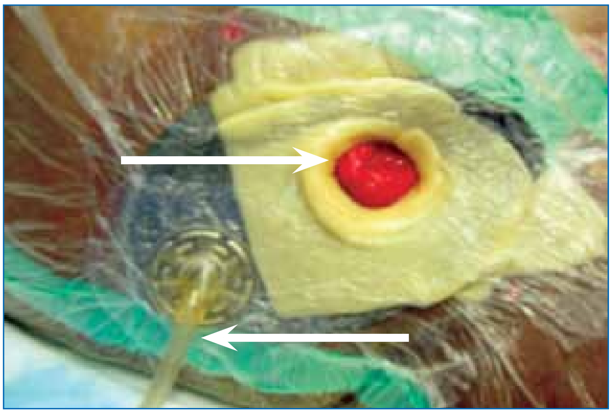


Figure 2f: Wounds, sponge and waxy plate covered with adhesive drape. A ± 2 mm^2 piece of adhesive drape cut away over dependent area of sponge. Suction pad placed here and vacuum applied. Sponge collapses, and waxy plates oppose, creating seal and isolation tract. Adhesive drape covering isolation tract carefully cut away. If seal is successful, then vacuum is maintained.

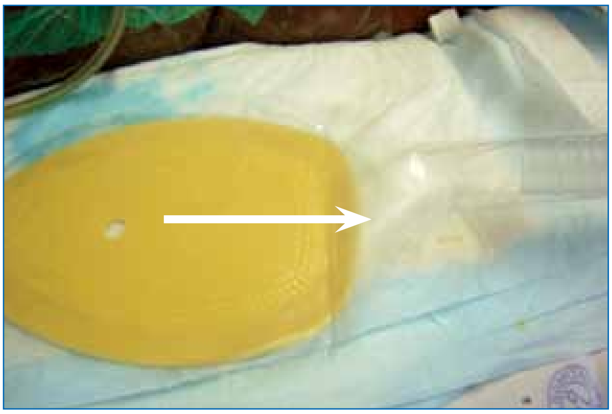


Figure 2g: Stoma bag to be placed over isolation tract for collection of effluent. In this case, ventilator tubing is attached to stoma bag. The wider bore tubing facilitates drainage of semi-solid stool. We found that conventional colostomy bags were inadequate in size, and required emptying too frequently. The wide-bore tubing and larger collection bottle prevents blockage and leakage, and saves on nursing time.

Figure 2h: Chest drain bottle attached to other end of ventilator tubing for collection of effluent. Patient with successful entero-atmospheric fistula isolation dressing. Chest drain bottle drainage system suitable for fluid effluent, and to be placed on floor for optimal drainage.

Successful placement of these dressings has been a major challenge, and our methods have advanced significantly. The performance and durability of these isolation dressings depend heavily on the characteristics of the entero-atmospheric fistulae. Accordingly, we have developed an isolation scoring system (Tables IV and V) to help predict the success of isolation dressings, and their feasibility in terms of success and cost benefit. Specialised commercial dressings are very costly and application is labour intensive. There are circumstances in which isolation dressings may not be the optimal solution. The isolation scoring ranges from easily isolatable fistulae (a score of 0) to extremely poorly isolatable fistulae (a score of 5), and correlates inversely with the time that each dressing is expected to last. We have found this scoring system to be remarkably accurate, although it is in accordance with our experience only.

Table IV: Isolation scoring components

Anatomical classification (output)	Positional classification	Structural classification
High 2	Accessible 0/inaccessible 2	Pouting 0/inverted 1
Moderate 1	Accessible 0/inaccessible 2	Pouting 0/inverted 1
Low 0	Accessible 0/inaccessible 2	Pouting 0/inverted 1

Table V: Isolation scoring in correlation to dressing durability

Isolation scoring	Days to leakage or replacement
5	< 1
4	1
3	2
2	3
1	4
0	> 5

For entero-atmospheric fistulae with an isolation scoring of 4 or 5, it is not cost-effective to use this isolation technique, nor is it beneficial to the patient. We recommend a more aggressive surgical approach to fistula closure. In these cases, time does not heal, and only serves to further sap the patient's reserves. A specialised isolation dressing may be attempted, but if it fails, do not waste resources on multiple attempts.

Closure of the entero-atmospheric fistula

Closure of the fistula may be either spontaneous or surgical. Spontaneous closure is more likely to occur if it is a low output fistula with no distal obstruction, and if it is a side fistula, as opposed to an end fistula. Other factors affecting spontaneous closure include the general nutrition of the patient, the absence of local and systemic sepsis, the absence of foreign bodies, e.g. pencil drains and catheters (Figure 3a and 3b), malignancy, epithelialisation of the tract and repeated trauma. Optimal medical management and the application of specialised isolation dressings assist in moving toward, and creating, the best environment for the entero-atmospheric fistulae to close spontaneously.

If it becomes evident that spontaneous closure is unlikely to occur, optimisation for elective surgical closure becomes the primary goal.

A further possibility is that of sequentially converting the entero-atmospheric fistula into an entero-cutaneous fistula with the aid of split skin grafting. This is much easier to manage long term, and can effectively be regarded as an "ostomy". Hopefully, the patient will be able to manage this at home, until such time as it is optimal for surgical closure.

Closure of the laparostome

Once the entero-atmospheric fistula has been closed, closure of the laparostome is the next objective. There is no favoured way of doing this. Typically, the general and plastic surgery teams will plan how best to achieve this, and what is best suited to the individual patient.

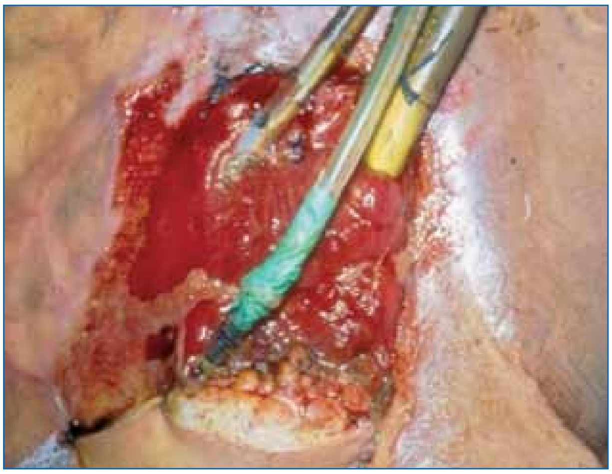


Figure 3a and 3b: Foreign bodies deleterious to fistula healing.

Procedures such as component separation and major flaps have been successful.

Conclusion

Entero-atmospheric fistulae are a disastrous complication of abdominal surgery and laparostomes. Patients with entero-atmospheric fistulae suffer significant morbidity, and often mortality. Entero-atmospheric fistulae have proven exceptionally difficult to manage well, and have many of their own complications. Patients must be approached from a global and localised perspective, with heavy focus on management of fluid balance, electrolytes and nutrition, and prevention of infective complications. Specialised dressing of the laparostome and fistula is essential for optimisation of the patient's condition before undertaking more definitive forms of management, as well as for dignity and quality of life. Depending on the fistula classification, the dressing method may be successful. Fistula isolation is the key concept behind these specialised dressings. Ultimately, the objectives are to achieve either spontaneous or surgical closure of the fistula, and closure of the laparostome.

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