REVIEW

Anastomotic leakage after gastrointestinal surgery: Diagnosis and management

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Summary Anastomotic leakage represents a major complication of gastrointestinal surgery, leading to increased postoperative morbidity; it is the foremost cause of mortality after intestinal resection. Identification of risk factors is essential for the prevention of AL. AL can present with various clinical pictures, ranging from the absence of symptoms to life-threatening septic shock. Contrast-enhanced CT scan is the most complete investigation to define AL and its consequences. Early and optimal multidisciplinary management is based on three options: medical management, radiologic or endoscopic intervention, or surgical re-intervention. Prompt treatment should help decrease postoperative morbidity and mortality, with the choice depending on the septic status of the patient. If the patient is asymptomatic, treatment can be medical only, coupled with close surveillance. Interventional management is indicated when the fistula is symptomatic but not life-threatening. On the other hand, when the vital prognosis is engaged, surgery is indicated, emergently, associated with intensive care. Even more than their prevention, early and appropriate management counts most to decrease their consequences. © 2014 Elsevier Masson SAS. All rights reserved.

Introduction

Onset of anastomotic leakage (AL) in gastrointestinal surgery is a major complication, often associated with increased postoperative morbidity, mortality and duration of hospital stay. The prevalence and consequences of AL vary according to the site of the anastomosis. For esophageal anastomoses, the incidence ranges from 2.7% to 15% [1–4]. The risk of anastomotic breakdown of colorectal anastomoses ranges between 5% and 20% [5,6]. The prevalence of pancreatico-enteric AL is even higher, occurring in between 20% and 25% of all pancreatoduodenectomies.

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AL usually occurs early, and can have both short- and long-term consequences. In the short-term, AL can be life-threatening because of septic or hemorrhagic complications, particularly for proximal AL with high enzymatic activity. AL is the principal cause of mortality after gastrointestinal resections, and mortality rate after AL ranges between 18% and 60% [2–4]. Long-term consequences of AL are dominated by anastomotic stenosis, with functional repercussions on patient quality of life. Lastly, onset of AL is a predictive factor for decreased long-term overall survival [7]. A negative impact on recurrence-free survival has been reported after colorectal resection for cancer [8]. The goal of this update is to present the general principles of diagnosis, and treatment of AL in gastrointestinal surgery, with a specific focus on esophagogastric, bariatric, pancreatic and colorectal surgery.

Predictive factors

Identification of predictive risk factors is an essential prerequisite for the prevention of AL. Performance of a gastrointestinal anastomosis should follow general overall rules, with specific variations related to the site and the type of tissues undergoing anastomosis.

Local factors

The site of the anastomosis is a risk factor in itself, because of difficulties in exposure or because of factors related to the technique i.e., biliary anastomosis above the superior convergence involving sectorial or segmental bile ducts. The environment can also influence the risk of AL, i.e., intra-thoracic negative pressure or elevated intra-lumenal bile duct pressure.

Several mechanical factors have been identified. They correspond most often to technical problems such as anastomotic tension, torsion or compression, too many sutures leading to local ischemia, or presence of a rigid drain lying in contact with the anastomosis [4, 9].

Certain local tissue conditions can also increase the risk of AL, i.e., cancer involvement at the gastrointestinal extremity [10], surgical site infection, poor tissue perfusion [11], or a defective muco-mucous approximation of the anastomosis.

General factors

Several systemic factors that are predictive of postoperative morbidity have been reported such as diabetes, the American Society of Anesthesiologists (ASA) score or tobacco/alcohol abuse, although a direct impact has never been clearly established in the literature. Conversely, several factors have been reported to be independent risk factors for postoperative AL (Table 1).

Diagnostic strategy

Clinical presentation

The clinical picture of AL can vary from complete absence of symptoms to life-threatening septic shock. Early diagnosis, even when signs are minor, offers the best guarantee to reduce the clinical severity and the consequences. When AL is adequately drained, the patient is usually asymptomatic and the diagnosis is made essentially because of the abnormal issue of digestive fluid in the drains. If the AL is not well drained, the patient usually has systemic signs and associated thoracic or abdominal symptoms according to the site of the anastomosis. The diagnosis is suggested by rapid deterioration of patient general status, fatigue, loss of appetite or sometimes, isolated neurologic disorders such as mental confusion. Fever and tachycardia are found in more than 50% of cases. Later signs include appearance of shock with hypotension, skin discoloration, or respiratory distress.

Intra-thoracic anastomosis

Signs of sepsis are related to mediastinitis or pulmonary disease, occasionally associated with arrhythmia, subcutaneous emphysema, thoracic pain, pneumothorax, or pleural effusion.

Intra-peritoneal anastomosis

The abdominal signs may be non-specific, but pain is usually intense, associated with peritoneal irritation, rebound tenderness or guarding.

Infra-peritoneal anastomosis

The symptoms include perineal pain, urinary tract functional signs or purulent drainage through the anus.

Bariatric anastomosis

In this setting, the abdominal signs are often masked. The most frequent signs are tachycardia, fever and tachypnea. Tachycardia greater than 120 and/or respiratory distress have been found to be independent predictive factors of AL [12–14].

Laboratory findings

Since any delay in the diagnosis of AL may worsen prognosis, several authors have looked for biologic factors predictive for AL. Other than increased leukocyte count, usually not very specific finding, C-reactive protein (CRP) on postoperative day 4 has been shown to be useful to detect AL in colorectal surgery [15]. Similarly, in bariatric surgery, CRP greater than 27 mg/dl on postoperative day 2 has been shown to be an important predictive factor for postoperative complications [16].

For pancreatic and biliary AL, the positive diagnosis relies on the levels of amylase and/or bile, in the drainage fluid. AL is characterized by amylase levels three times higher than serum levels starting on postoperative day 3 [17, 18]. Nonetheless, not all pancreatic and biliary AL are detected by these levels [19], and not all surgeons routinely insert drains in these operations.

Imaging

Contrast-enhanced thin slice multidetector CT scan

Contrast-enhanced thin slice multidetector CT scan is the best imaging technique for AL and its consequences. For gastrointestinal AL, upper or lower GI lumenal opacification is performed accordingly. Besides permitting the diagnosis of AL, CT scan allows:
Table 1  Risk and protective factors for anastomotic leakage according to the site of anastomosis.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Protective factors</th>
</tr>
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<tbody>
<tr>
<td>General factors for all sites of anastomosis</td>
<td>Obesity (BMI &gt; 30)</td>
</tr>
<tr>
<td></td>
<td>Intra-operative blood loss</td>
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<tr>
<td></td>
<td>Preoperative malnutrition (albumin &lt; 3.0 g/dl)</td>
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<td></td>
<td>Long-term steroid therapy</td>
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<td></td>
<td>Arterial hypotension with altered peripheral vascular network</td>
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<tr>
<td>Biliary anastomosis</td>
<td>Preoperative radiation</td>
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<tr>
<td></td>
<td>Small caliber bile ducts</td>
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<tr>
<td></td>
<td>Anastomosis proximal to the superior convergence</td>
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<tr>
<td>Pancreatic anastomosis</td>
<td>Advanced age</td>
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<tr>
<td></td>
<td>Healthy (soft) or steatotic pancreatic parenchyma</td>
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<tr>
<td></td>
<td>Small main pancreatic duct (&lt; 2 mm)</td>
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<tr>
<td>Esophageal anastomosis</td>
<td>The lack of esophageal serosa</td>
</tr>
<tr>
<td></td>
<td>Longitudinal disposition of muscular fibers</td>
</tr>
<tr>
<td></td>
<td>Cervical anastomosis (tension)</td>
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<tr>
<td></td>
<td>Intra-thoracic anastomosis (negative pressure)</td>
</tr>
<tr>
<td>Bariatric surgery anastomosis</td>
<td>Advanced age</td>
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<td></td>
<td>Male gender</td>
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<tr>
<td></td>
<td>Sleep apnea syndrome</td>
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<tr>
<td></td>
<td>Morbid obesity (BMI &gt; 40)</td>
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<tr>
<td></td>
<td>Antecolic Roux-en-Y anastomosis</td>
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<tr>
<td>Colorectal or colo-anal anastomosis</td>
<td>Male gender</td>
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<tr>
<td></td>
<td>Smoking history</td>
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<tr>
<td></td>
<td>Low anastomosis</td>
</tr>
<tr>
<td></td>
<td>Preoperative immuno-nutrition (before carcinologic resection)</td>
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<tr>
<td></td>
<td>Low intra-luminal pressure</td>
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<tr>
<td></td>
<td>Fibrous pancreas</td>
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<tr>
<td></td>
<td>Trans-anastomotic external drainage of the main pancreatic duct</td>
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<td>Somatostatin analogues</td>
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<tr>
<td></td>
<td>Pan-parietal suture purchase</td>
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<tr>
<td></td>
<td>Side-to-side semi-mechanical anastomosis</td>
</tr>
<tr>
<td></td>
<td>Gastric ischemic conditioning (ligation of left gastric artery)</td>
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<tr>
<td></td>
<td>Surgeon experience</td>
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<tr>
<td></td>
<td>Protective ileostomy</td>
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<tr>
<td></td>
<td>Aspirative pelvic drainage</td>
</tr>
</tbody>
</table>

- evaluation of the viability of the gastrointestinal limbs;
- elimination of a septic cause;
- detection of an eventual poorly drained collection or abscess;
- evaluation of the accessibility;
- guidance for drainage, as necessary.

Fistulography and contrast-enhanced gastrointestinal opacifications
Fistulography and contrast-enhanced gastrointestinal opacifications are currently debated, because of the high rate of false negatives. Other more specific complementary investigations can be performed to pinpoint the diagnosis and contribute to management and therapeutic strategy.

Endoscopy
Endoscopy should be performed with minimal insufflation by an experienced endoscopist for suspected esophageal or colorectal AL with the surgeon standing by. This investigation helps determine the size of the anastomotic dehiscence and can assess the viability of the tissues and eventually lead to intra-luminal management.

Cholangiography
Cholangiography, for bilo-enteric AL, is highly sensitive and allows determination of the size of the dehiscence while providing a roadmap of the biliary ducts. Cholangiography can be performed easily when the patient has a trans-anastomotic drain in place. If not, MRI-cholangiography with injection of a contrast material that is eliminated in the bile is an alternative.

Therapeutic strategy
General principles for management
Once the diagnosis of AL is established, several therapeutic options are possible:
- medical treatment alone;
- radiologic or endoscopic interventional management;
- or surgery.

Management is ideally multidisciplinary, involving surgeons, intensivists, gastro-enterologists and radiologists. Early transfer to an expert center or a request for expert consultation are important. Prompt management is of primordial importance because AL exposes the patient to a risk of sepsis with potential catastrophic aggravation, and to a hemorrhagic risk by vascular erosion when an upper GI fistula has high enzymatic activity. Early management improves the prognosis since it increases the possibility of preservation of anastomoses and reduces the duration of hospital stay [20].

The goal of treatment is to control the sepsis, irrespective of its severity, and to ensure complete, directed, external fistulization. While the clinical consequences of sepsis constitute the principal decisional factor in management, other parameters must also be considered: the effectiveness of external drainage of the AL, the extent of anastomotic disunion, the viability of the anastomosed
gastrointestinal structures, the interval between the operation and the onset of AL, and the presence or absence of mechanical or functional downstream obstruction.

In the asymptomatic patient
An AL that is either blind (in particular for rectal anastomoses) or perfectly directed by a drain placed intraoperatively adjacent to the anastomosis may be without clinical consequences. No further treatment is necessary initially. The drain should be left in place until the fistula dries up completely. In the absence of improvement, specific treatment of the fistula should be envisioned. Close surveillance in an appropriate surgical unit is necessary, because, in case of sudden aggravation, management has to be adapted immediately.

In patients with clinical signs but without life-threatening consequences
When the patient has septic signs without organ failure, this means that AL drainage is incomplete, or nonexistent. Imaging allows evaluation of the intra-thoracic or intra-abdominal consequences of sepsis, which should be treated. In the presence of signs of sepsis, broad spectrum antibiotics, active against gastrointestinal Gram-negative and anaerobic bacteria should be started after obtaining blood cultures and bacteriologic sampling of the drainage exudate. Antibiotic therapy should then be adapted to the bacteriologic sensitivity testing with particular attention paid to fungal supra-infection that might call for additional antifungal antibiotics.

In this setting, radiologic percutaneous or endoscopic management is generally indicated. Interventional management allows initial control of sepsis, either by assuring optimal drainage by external fistulization, or by LA closure. Surgical re-intervention should be considered only if:
- sepsis is severe with life-threatening symptoms;
- diffuse peritonitis or pleurisy is present;
- conservative treatment fails or is insufficient;
- there is ischemia of anastomotic structures.

Occasionally, AL occurs early, within the first two postoperative days, and should lead to suspicion of either a technical problem, or ischemia of one of the gastrointestinal segments; this calls for early re-operation with anastomotic reconstruction before septic signs appear.

In case of clinical signs with life-threatening consequences
In patients who present with severe sepsis and multigorgan failure, management should be early, quick and aggressive. This includes transportation to intensive care, rehydra- tion and respiratory optimization with physical therapy or mechanical ventilation as necessary. Surgically, urgent re-operation should be performed via a laparotomy for the abdomen or a thoracotomy for the thorax, and only rarely by laparoscopy, according to surgeon expertise. Operation consists of evacuation of septic fluids, bacteriologic cultures, lavage of the infected spaces (peritoneal or pleural toilette, with decortication as necessary), and effective drainage. After identification of the AL, treatment must be adapted to the specific insult, depending on local (sepsis, ischemia) and systemic (hemodynamic status, organ failure) conditions, with several possible options, according to the site of the anastomosis.

Anastomotic fistula after bariatric surgery
AL and bleeding are the principal complications observed after gastric bypass (GBP) and sleeve gastrectomy (SG). As for gastrointestinal resections with anastomosis, there is a risk of AL at the level of each suture line. After GBP, leakage is usually located at the level of the gastric pouch or the gastrojejunosotomy suture lines. Clinical repercussion is often insidious, and sometimes even completely asymptomatic. Manifestations of AL at the level of the jeuno-jejunostomy or the distal gastric division include intense abdominal pain, associated with infectious or peritoneal signs that leave no doubt as to the surgical indication. After SG, AL typically occur near the upper edge of the staple line. It is indispensable to ensure that there is no stenosis or obstruction distal to the AL, or at the level of the biliopancreatic loop for GBP; this could not only be the cause of the AL, but could also result in persistence of the leak [21].

Medical treatment
When AL is asymptomatic, treatment can be conservative [22]. The patient should be kept NPO, and receive intravenous antibiotics, proton pump inhibitors and nutritional support. Distal enteral feeding via a nasojugal tube is preferable [23]. Somatostatin analogues may reduce digestive secretions and the output of the AL. All drains already placed should remain in place. A GI follow-through X-ray with water-soluble contrast is repeated a few days later, and then at regular intervals until the fistula closes, thus allowing progressive re-alimentation [21].

Non-surgical intervention treatment
Placement of intra-lumenal covered stents by interventional endoscopy can reduce the AL output by isolating the gastrointestinal lumen and allowing re-alimentation without compromising healing. In case of gastric stricture distal to the fistula after SG, stent placement reduces the output by improving downstream outflow. Nonetheless, the rate of failure or complications is 20%, related either to incomplete covering of the AL, or to migration of the stent.

Surgical treatment
In case of surgical re-intervention, different procedures are possible:
- primary closure of the leak may be feasible in case of very early re-operation when the quality of surrounding tissues is still satisfactory;
- directed fistulization, either after intubation of the dehis- cence with a Pezzer cathether, or by approximation of the edges associated with wide drainage. The leak can also be covered with an omental flap.

In the case of a distal leak, a gastrostomy tube is imperative to decompress the excluded stomach and protect the repair. The cause of gastric distension must be sought; most often, this is a kink or torsion of the biliopancreatic loop [21].

In case of chronic symptomatic fistula, with multiple re-operations, certain radical measures can be necessary; for example, performing a Roux-en-Y and either anastomosing it the tissue defect [24], or using it simply as a serous patch [21]; more rarely, total gastrectomy is required. Once again, this underscores the importance of early management and successful control of the AL.
Fistula after esophagogastric or esophagojejunal anastomosis

When the patient is asymptomatic and the AL is exteriorized, medical treatment can be proposed (Fig. 1). For symptomatic AL, on the other hand, treatment can be either conservative or surgical, according to clinical severity, the status of the plasty (evaluated by endoscopy) and the site of the anastomosis. Cervical leaks are more frequent, but less morbid; they require early and routine repeat surgery when they are symptomatic because they can lead to mediastinitis or cervical osteomyelitis. The re-operation allows verification of the viability of the plasty and drainage of the fistula.

Medical treatment

Management of this type of AL includes routine fasting, aspirative drainage of gastric secretions and administration of PPI’s. Even if the leak is minimal, antibiotic therapy should be prescribed to avoid mediastinitis. Nutritional support is indispensable, and a randomized trial has shown distal enteral feeding to be superior to TPN in this setting [25].

Non-surgical interventional treatment

Conservative treatment should be favored, except when early AL with major sepsis or symptomatic cervical AL is present. This implies medical treatment, optimal drainage and endoscopic closure of the fistula.

First-line drainage can be performed percutaneously under CT guidance [2]. Nonetheless, two endoscopic alternatives, not yet validated, have been described recently, and should be discussed case by case in the event of organized peri-anastomotic collections. Evaluation of these techniques would be difficult because AL is rare and variable, by nature. These include:

- double pig-tail catheter internal drainage. This type of drainage can be useful and enhance anastomotic healing [26];
- negative pressure therapy corresponding to endoscopic insertion of a polyurethane sponge into the abscessed cavity, combined with lumenal aspiration via a nasal tube [27].

Concerning endoscopic closure of the AL, several techniques can be discussed:

- insertion of an extractable covered metallic stent is proposed in fistulas involving up to 50–70% of the lumenal circumference [28]. Even though there are no controlled randomized studies, a review of the literature seems to indicate that placement of a covered stent for 6 to 8 weeks should allow effective treatment of AL [29]. Potential complications include obstruction or erosion of the Roux-en-Y loop or stent migration;
- use of hemostatic clips, possibly in association with fibrin glue [30]. These clips can be used to close large defects but are not robust enough to approximate altered fistulous edges. The efficacy of these procedures is limited by the size of the dehiscence (1 cm for glue and 2 cm for clips) [30,31];
- use of recently-introduced Ovesco® “wolf-trap” OTS clips, has been described in several publications involving a variety of different localizations and causes of AL, some of which were very rare such as a leak from a esophago-jejunoanastomosis [32]. The advantage of these clips is their wide purchase allowing closure of holes as large as 30 mm in diameter with a closing force of 8–9 Newtons, much more robust than classical hemostatic clips [32,33]. Their efficacy is less optimal in organized AL as compared with recent perforations or AL, because of retraction and
inflammatory fibrosis. These alternative techniques might be advantageous, but because of limited scientific data, they should be discussed case by case in expert centers.

Surgical treatment
For cervical AL, surgical treatment consists of systematically re-opening the cervicotomy, draining and inserting a Pezzz catheter. Healing is calibrated by the nasogastric tube, left in place during the healing period.

For thoracic or abdominal AL, the different surgical options include:

- reinforcing the anastomosis with sutures, which is possible only in the absence of severe local infection or ischemia;
- reconstruction of the anastomosis, performed when the disunion is caused by a mechanical problem or very localized ischemia. This technique should be considered only in the absence of intense inflammation [34], but it carries a high-risk of developing a new AL later on [31];
- trans-anastomotic intubation associated with continuous endolumenal irrigation, which is possible when the disunion is less than one-third of the circumference. The disunion can be intubated with a T-tube, an air vent and endolumenal irrigation, thanks to a nasogastric tube [34]. This technique remains debated among experts;
- dismantling the anastomosis, in combination with either esophagostomy for intra-thoracic esophago-gastrostomies, or intubation of the esophagus and exteriorization and conversion of the Roux limb into a terminal jejunostomy for intra-abdominal esophago-jejunostomies. This technique is recommended when the anastomotic dehiscence involves more than half of the circumference, or when the intestine is necrotic. This solution, even if radical and more aggressive, can be life-saving in the short-term. The anastomosis can be reconstructed later on.

AL after biliary or pancreatic anastomotic leakage

Asymptomatic patient
For biliary AL, drainage is maintained until the fistula dries up completely, then removed gradually (Fig. 2). For pancreatic AL, the drain should be mobilized steadily, ideally under CT guidance, in order to detect any collection that might need further drainage [17]. The patient can usually maintain oral feeding; only persistent and/or prolonged pancreato-gastric AL, even well tolerated, can sometimes require fasting.

Under certain conditions (patient well-informed, with good home support, living near the hospital, and not under therapeutic anticoagulation therapy), an asymptomatic biliary or pancreatic fistula can be treated as an out-patient procedure if return visits, laboratory investigations and repeated imaging are available [22,34–38].

Medical treatment
For pancreatic AL, except when the patient is asymptomatic, the question is whether to stop oral feeding in order to decrease exocrine secretion [35], notably in the patient with pancreatico-gastrostomy [39]. Associated nutritional support (total parenteral nutrition or eventually continuous enteral nutrition by nasojunal drip via a tube placed in the efferent loop of the gastrojejunostomy) is recommended. A randomized trial has shown that continuous enteral nutrition improved the rate of and/or the interval to closure of pancreatic AL [40]. Re-alimentation is only possible when the infectious syndrome has been well controlled [35] and when the AL output is low (less than 50 ml/day). Somatostatin® or its analogues can be used when the output is high (> 100 or 200 ml/day), because they decrease the output and/or shorten the course of these AL [39–42].

![Figure 2](image-url)  
**Figure 2.** Management algorithm for biliary or pancreatic anastomotic leakage.
Non-surgical interventional treatment
All collections that result in intra-peritoneal sepsis should be treated by modifying the drainage currently in place (simple mobilization or change of drain via the same tract) or by percutaneous radiologic drainage [39,43]. For high-output biliary AL with large anastomotic disunion, the AL should be treated, either by a transhepatic trans-anastomotic internal/external drain or by a stent that intubates the anastomosis. This technique, initially a percutaneous transhepatic procedure, can be performed even on small caliber intra-hepatic biliary ducts [44]. The biliary drains should be left in place several weeks after the fistula has dried up in order to limit the risk of stricture.

Surgical treatment
In case of surgical re-operation, several treatments are possible:
• directed fistulization by wide drainage in contact is simple and rapid, and suitable for patients with limited loss of substance or in patients who are hemodynamically unstable that an abbreviated laparotomy is indicated. For pancreatic AL, simple “contact” drainage risks protracted exposure of the arterial stump [43], all the more so since omental interposition is generally impossible in this context;
• intubation of the dehiscence with a T-tube or Pezzer catheter is a generally easy method to perform and applicable if the biliary and pancreatic lesions have only limited necrosis. Intubation guarantees optimal and direct drainage of the fistula, allowing optimal protection of the vascular stump and allows healing over a stent. This method is probably the best because it is easy, safe and effective when re-operation is necessary, in particular, for bilio-enteric fistula;
• reconstruction of the anastomosis is discussed when the disunion is complete with loss of substance, if local conditions allow, i.e. absence of local sepsis or substantial diffuse necrosis. Resection of biliary, pancreatic or intestinal tissues back to well-vascularized tissues is necessary combined with optimal drainage to protect the high-risk anastomosis. One of the particularities of pancreatico-jejunostomy is that it can be transformed into pancreatico-gastrostomy in expert hands and in case of early management of the AL [45];
• suppression of the anastomosis: in case of complete dehiscence of the biliary anastomosis, it is sometimes easier, under salvage conditions, to directly intubate the bile duct to ensure optimal external drainage. For pancreatic anastomoses, the procedure consists of closure of the jejunum and insertion of a drain into the main pancreatic canal to ensure the external drainage of the pancreatic stump with a contact drain. This creates an external pancreatic fistula and may result in prolonged drainage. Ultimate treatment can require endoscopic treatment in the case of pseudocyst and sometimes re-operation is necessary;
• particular case of totalization of pancreatectomy for pancreatic AL. Because of its immediate risks (hemorrhage, mortality) and metabolic consequences, this technique should be reserved for the most severe cases (extended pancreatic necrosis) [44—47].

AL after colorectal or colo-anal anastomosis
Asymptomatic patient
Patients with blind fistulas, generally discovered by contrast opacification performed before protective ileostomy reversal, may be asymptomatic (Fig. 3). No complementary treatment is necessary, but it is preferable to delay ileostomy reversal until a repeat opacification has shown resolution of the blind fistula. The median delay to complete healing is between four and five months [48]. If the AL

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**Figure 3.** Management algorithm for colorectal or colo-anal anastomotic leakage.
persists longer than six months and there are no associated abscesses on imaging, an anal examination under general anesthesia is indicated to evaluate the tract. If the tract is large, and/or the anastomosis is structured, insertion of a soft drain for irrigation can enhance healing. Otherwise, the ileostomy can be reversed in most patients without long-term consequences [49].

Surgical conservative treatment via the anal or interventional route

Conservative treatment is indicated when sepsis is controlled. Anal examination under general anesthesia is recommended. If not already performed, a protective ileostomy should be brought out during the same anesthesia.

For patients with low colorectal or colo-anal anastomoses, dependent drainage of the abscess should be established into the digestive tract, or via a perineal route during a short anesthesia. If the fistulous tract is adequately identified, the anastomotic dehiscence can be enlarged, the walls of the abscess cured and the cavity drained by one or two trans-anastomotic drains that exit through the anus and are left in place to allow subsequent irrigations [50]. Insertion of an Endosponge® combined with aspirative drainage, a truly negative pressure treatment of AL, is now used more and more frequently. This system allows continuous drainage of secretions, without any accumulation, and accelerates healing by favorizing granulation [51,52]. Another alternative is exteriorization of a double J (pig-tail) drain through the anus.

When the fistulous tract cannot be identified by transanal digital examination, or when the colorectal anastomosis is located higher, it is preferable not to perforate the colon and resort to percutaneous trans-gluteal radiologic drainage [53]. Even though the efficacy of this type of drainage is lower (creation of a supplementary tract between the abscess and the wall, non-cured accessible cavity, less efficient lavage), re-operation can be avoided in 50% of cases [53]. The endoscopic approach is also an alternative. In case of failure of all these procedures. Nonetheless, it is sometimes necessary to resort to surgical drainage via the abdomen with preservation of the anastomosis.

Surgical treatment via laparotomy

In case of severe life-threatening sepsis, surgical re-operation via laparotomy offers two possible therapeutic options:

- preservation of the anastomosis with placement of multiple contact drains in contact with the AL (Mikulicz drain), combined with a lateral diverting stoma if the latter has not already been made. This can be performed simply and rapidly, and allows stoma reversal as soon as the AL has healed. On the other hand, the risks are persistence of pelvic sepsis due to insufficient drainage, chronic AL and ultimately, anastomotic stricture;
- dismantling the anastomosis and creation of a left iliac stoma. A transanal pelvic drainage can be placed via the rectal stump that is left open with the advantage of radical treatment of pelvic sepsis and the AL with low operative mortality. The disadvantage is creating a difficult, more complex reconstruction procedure in a “frozen pelvis” with a high-risk of definitive stoma [49,50,54,55].

The choice between these two attitudes is difficult but determines the long-term consequences of fistula and impacts the risk of definitive stoma [54,55]. While the main objective is to avoid a fatal outcome, the second goal is the long-term management of the AL.

Dismantling the anastomosis is recommended for:

- patients in shock requiring pressor drugs;
- ischemia of the mobilized colon;
- fecal peritonitis with false membranes and abraded pelvic peritoneum;
- disunion greater than half of the anastomotic circumference.

In all other cases, it seems preferable to preserve the anastomosis, all the more when the anastomosis is low, the patient is young, the disease is benign or, if malignant, associated with good prognosis, and finally, in patients in whom it will be difficult to re-establish gastrointestinal continuity soon thereafter.

Particular case of intra-abdominal ileo-colic AL

The incidence of AL after ileo-colic anastomosis is low, ranging from 0.02 to 4% in the literature [56]. The general risk factors for ileo-colic AL are not much different from any other site (Table 1), and in particular, the technique of anastomosis (mechanical or hand-sewn) does not seem to influence the onset of AL [57]. In the particular case of ileo-colic AL in patients with Crohn’s disease, use of monoclonal anti TNFα antibodies (Remicade®, Humira®) in the three months preceding the operation increases the risk of AL, unless a protective stoma is performed [58].

As for other types of AL, the therapeutic strategy depends on the clinical presentation (cf. above “general principles of management”). If the peri-anastomotic abscess is less than 3 cm and without associated systemic signs, drainage is not recommended. Broad spectrum antibiotic therapy usually suffices within a few weeks. In case of localized peritonitis with moderate septic signs, percutaneous radiologic drainage is the best solution:

- when the size of collections is greater than 3 cm;
- the site is easily puncturable;
- the number of collections is limited.

After needle puncture, a drain is left in place for regular lavage. Clinical improvement is usually obtained within 48 hours; otherwise re-operation should be considered. In cases of surgical re-operation, if the AL is major, the anastomosis should be resected with creation of a double stomy through the same orifice for proximal anastomoses (ileo-colic and right colo-colonic), or performance of Hartmann’s operation for distal anastomoses [56,59]. If the AL is minimal, anastomotic repair with proximal diverting stoma and contact drainage is advised, or else the anastomosis can be resected and reconstructed, but here too with a proximal diverting stoma. These two options are possible only when local and general conditions allow: a hemodynamically stable patient with neither denutrition nor obesity, absence of inflammatory disease and an anastomosis with absolutely no tension, performed on well-vascularized and non-inflamed tissues. In any case, continuity is re-established no earlier than three months later, to avoid intra-peritoneal inflammatory adhesions that would make adhesiolysis more risky.

Conclusion

AL in gastrointestinal surgery occurs relatively frequently, and can sometimes be severe and difficult to manage. Identification of risk factors is essential for prevention. Diagnosis
should be early, and management should be specific and multidisciplinary. Delay in diagnosis compromises prognosis. Treatment can be medical, interventional radiological, endoscopic, or surgical. The therapeutic choice depends initially on the septic status of the patient. When the patient is asymptomatic, treatment is medical exclusively. Intervventional management is entertained when AL is symptomatic but not life-threatening. When AL is life-threatening, emergency surgery is required in conjunction with intensive care. While prevention is important, it is the precocity and quality of management that decreases the consequences of AL.

ESSENTIAL POINTS
- Anastomotic leakage is a major complication that increases morbidity and mortality.
- Knowledge of risk factors is essential for optimal management.
- Diagnosis must be early and suggested even in the presence of non-specific signs.
- Management should be multidisciplinary and therapeutic options should include medical treatment, interventional radiology, endoscopy, and surgery.
- Management should be medical in pauci-symptomatic patients, interventional radiology in non-life-threatening situations, and surgery with intensive care support in case of severe sepsis.

Disclosure of interest
The authors declare that they have no conflicts of interest concerning this article.

References


