

Anastomotic Leakage after Upper Gastrointestinal Surgery: Surgical Treatment

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Keywords

Leakage · Complication · Esophagectomy · Gastrectomy · Pancreatectomy

Summary

Background: Anastomotic leakage after upper gastrointestinal surgery is associated with major morbidity and mortality. In recent years, there was a major paradigm shift in the management of leakage after upper gastrointestinal surgery from surgical towards conservative and endoscopic treatment approaches as first-line treatment options. **Methods:** We conducted a PubMed literature search using combinations of the keywords ‘leakage’, ‘complication’, ‘esophagectomy’, ‘gastrectomy’, and ‘pancreatectomy’ to identify relevant publications. **Results:** Surgical re-intervention after esophagectomy, gastrectomy, or pancreatectomy is still indicated in selected patients, depending on the severity of symptoms, the condition of the patient, and failure of initiated treatment. Furthermore, surgical revision after esophagectomy and gastrectomy is indicated for early leakage and depends on the extent of anastomotic disruption and the condition of tissue. **Conclusion:** Surgical re-intervention still plays a crucial role in the management of leakage after upper gastrointestinal surgery, especially in critically ill patients and after failure of conservative or endoscopic treatment.

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Anastomotic Leakage after Esophagectomy and Gastrectomy

Introduction

Anastomotic leakage after esophagectomy and gastrectomy is a feared and life-threatening complication [1, 2]. Incidences of anastomotic leakage after esophagectomy range between 0 and 40% [3–5], with higher leakage rates after cervical than intrathoracic anastomoses [1, 6]. While some authors did not report increased mortality after intrathoracic leakage [7], a large number of studies postulated an elevated leakage-related mortality between 18.2 and 35% [8–12], with a threefold higher risk of mortality after leakage [12]. Furthermore, patients requiring surgical treatment for leakage had worse outcome compared to patients with conservative management [13].

With regards to total gastrectomy, incidence of leakage ranges between 0 and 17% [14–16]. Increased leakage-related mortality was described as 19–64%, with higher mortality after surgical compared to conservative/endoscopic treatment [17, 18].

The time to diagnosis of leakage after esophagectomy ranges between 1 and 38 days, with a median of 7–14 days. While the majority of leakages occur in the later postoperative course, some patients present early leakage within the first 1–5 days after surgery [1, 2, 5, 19]. The median time to diagnosis of leakage after gastrectomy is similar with 7.5 days after surgery [20].

Conduit necrosis is another devastating complication after esophagectomy, often resulting in leakage [21, 22]. Luckily, conduit necrosis is not very common with an estimated incidence of about 2% [21]. However, in laparoscopic series, necrosis was reported in up to 13% [14]. Mortality due to this complication reaches up to 90% [21, 22].

Table 1. Definition of anastomotic leakage^a after esophagectomy (modified from [23])

Type	Extent and treatment
Type I	local defect requiring no change in therapy or treated medically or with dietary modification
Type II	localized defect requiring interventional but not surgical therapy, e.g. interventional radiology drain, stent or bedside opening, and packing of incision
Type III	localized defect requiring surgical therapy
^a Defined as: Full thickness gastrointestinal defect involving esophagus, anastomosis, staple line, or conduit irrespective of presentation or method of identification.	

Consensus Definition of Leakage and Conduit Necrosis

In 2015, the Esophagectomy Complications Consensus Group (ECCG) addressed the issue of incoherent reporting on postoperative complications such as leakage and conduit necrosis [4, 23]. Table 1 and 2 provide an overview about new classifications as proposed by the expert panel [23].

General Management of Anastomotic Leakage and Conduit Necrosis

Management of anastomotic leakage and conduit necrosis after esophagectomy and gastrectomy requires a multidisciplinary team approach. Early and aggressive treatment is vital in order to prevent the patients' deterioration [1, 24]. Management depends on factors such as location of anastomosis, time point of diagnosis of leakage, extent of anastomotic disruption, perfusion/ischemia/necrosis of conduit, involvement of surrounding organs, whether or not the leakage is contained, clinical symptoms (e.g. sepsis), success of initiated management, and others [1, 6, 19, 24].

Most patients present only minor (contained) leakage and are relatively asymptomatic. Based on recent improvements and developments in conservative and endoscopic treatment options, these patients can mostly be managed without surgical re-intervention, and conservative or endoscopic approaches are nowadays considered the first-choice treatment in these selected patients [1, 5, 14, 17, 19, 22, 24–28].

Surgical Treatment of Leakage after Esophagectomy and Gastrectomy

Despite the fact that the majority of leakages can be managed conservatively or endoscopically, there are a few indications for surgical re-intervention.

General Principles of Surgical Treatment of Anastomotic Leakage

If revision surgery is required, treatment has to adhere to a few general principles. First, exploration of the anastomotic site to fully assess the extent of leakage and potential ischemia/necrosis is es-

sential to guide further treatment [1]. Second, decontamination of the surgical site by means of a thorough wash-out, decortication of the thoracic cavity from necrotic and fibrotic tissue, abscess debridement, and so forth are crucial for sepsis control [1, 2, 19]. Third, adequate internal and external drainage of the leakage has to be established by using large drains and nasogastric tubes [1, 2, 19, 24, 26]. A T-tube drain can be placed directly into the defect to direct leakage [1].

Surgical Treatment of Leakage after Esophagectomy: Intrathoracic Leakage

Indications for surgical re-intervention depend on four aspects:

- (1) Severity of symptoms and condition of patient: If patients present uncontained leakage or are symptomatic with signs of sepsis and clinical deterioration, surgical intervention is indicated or needs at least to be considered in order to assess the extent of leakage and conduit ischemia/necrosis [2, 22, 28]. If the leakage is small, if the anastomosis is vital, and if the conduit does not present signs of advanced ischemia or necrosis, leakage can be closed directly [2]. In case of partial necrosis, re-fashioning of the anastomosis after resection of necrotic tissue might be feasible. Intestinal continuity can be maintained in the majority of patients [2]. In cases of extensive conduit necrosis or in patients with severe septic shock, surgical diversion with resection of the necrotic part or maybe the entire conduit is necessary, followed by cervical esophagostomy and venting gastrotomy/jejunostomy [2].
- (2) Failure of initiated treatment – step-up approach: If patients initially qualify for conservative or endoscopic treatment, constant re-evaluation needs to document clinical improvement and control of symptoms [24]. In case of further clinical deterioration or signs of persistent uncontrolled leakage, surgical re-intervention is indicated [2, 22, 28].
- (3) Early leakage: Early leakages (within the first 72 h) are usually attributed to technical failure [1, 14], or develop on the basis of conduit necrosis with subsequent fulminant septic shock and rapid clinical deterioration [1, 5, 22]. In addition, early leakage is often not contained [24]. Hence, early leakage is an indication for surgical revision [1, 5, 14, 22, 24]. If patients present in good condition, direct closure or redo of the anastomosis can be considered [14]. In case of fulminant sepsis, take-down of the anastomosis is required with diversion [1, 5, 22].

Table 2. Definition of conduit necrosis after esophagectomy (modified from [23])

Type	Extent	Diagnostics	Treatment
Type I	conduit necrosis focal	identified endoscopically	additional monitoring or non-surgical therapy
Type II	conduit necrosis focal	identified endoscopically and not associated with free anastomotic or conduit leak	surgical therapy not involving esophageal diversion
Type III	conduit necrosis extensive		treated with conduit resection with diversion

(4) Extent of anastomotic disruption and level of containment: If the leakage is large (>2 cm), exceeds one third of the anastomosis, or resembles even a near-circumferential breakdown of anastomosis, surgical revision is usually necessary [1, 2, 14, 26, 28]. Furthermore, non-contained intrathoracic leakage bears a high risk of sepsis, thus requiring surgical re-intervention as well [2, 5, 22, 28]. Surgical options include again primary repair or diversion [5, 14, 19, 28].

Surgical Treatment of Leakage after Esophagectomy:

Cervical Leakage

The management of cervical leakage differs from that of intrathoracic leakage due to the reduced risk of life-threatening mediastinitis [6] and less severe symptoms [5, 14, 22]. However, incidence of cervical leakage is higher [5, 14].

In general, re-opening of the cervical wound is recommended. This allows effective external drainage in combination with internal drainage [1, 6, 22, 24]. Some authors even proposed surgical revision as an alternative to endoscopic examination, as it allows evaluation of the anastomotic defect with immediate surgical treatment [1]. Direct closure of leakage or re-fashioning of the anastomosis can be attempted, especially in early leakage [1]. In case of more extensive leakage, resection of necrotic areas is recommended. Direct repair of anastomosis is often critical in these cases due to reduced perfusion or tension, or due to local and systemic inflammation [6]. Alternative options include placement of T-drains into the leakage or resection of anastomosis with cervical esophagostomy and delayed reconstruction [1, 6, 24]. If local drainage is insufficient, if sepsis does not resolve, or if cervical leakage leads to mediastinitis or intrathoracic complications, surgical treatment has to be more aggressive [22].

Surgical Treatment of Conduit Necrosis/Ischemia after Esophagectomy

Some authors favor urgent surgical revision in every patient with necrosis of the conduit [1, 24]. However, some patients might qualify for conservative or endoscopic therapy [23]. The majority of cases requires immediate surgical re-intervention, though. This especially applies to patients with early fulminant leakage [5], extensive necrosis or large leakage [28], or profound septic shock [2].

Surgical options include resection of the necrotic area and redo of anastomosis if the conduit is long enough and the anastomosis

can be safely established in a viable area. The patient has to be in a good condition for this treatment [2, 24]. In case of extensive conduit necrosis, or in highly septic and unstable patients, damage control is the main objective and diversion is the surgical procedure of choice [2, 5, 14, 21, 22, 24]. Immediate reconstruction is explicitly not recommended and should be carried out after recovery [24].

Surgical Treatment of Leakage after Gastrectomy

General management of leakage after gastrectomy adheres to the same principles as management of leakage after esophagectomy, and the same aspects are relevant for surgical re-intervention:

- *Severity of symptoms and condition of patient:* The severity of the patient's condition is highly important for the adequate choice of conservative/endoscopic versus surgical treatment [24, 27]. Surgical management is being proposed if the following does apply:
 - sepsis with one or multi-organ failure,
 - signs of diffuse peritonitis,
 - inefficient drainage through a radiological or endoscopic approach,
 - jejunal limb necrosis.
- *Failure of initiated treatment – step-up approach:* In case of failure of conservative treatment, surgical management is indicated [14, 17]. Surgical options include direct repair of anastomosis, redo of anastomosis, or take-down of anastomosis with abdominal jejunostomy and closure of the esophagus combined with endoluminal drainage or – in case of extended gastrectomy – cervical esophagostomy [1, 24].
- *Early leakage:* Early leakage (<72 h after initial operation) is usually being interpreted as a technical error [1, 17]. Surgical re-intervention is recommended with the aim to potentially redo the anastomosis, or to directly close leakage. This option, however, is only available if leakage is small and anastomosis is vital without (or with only minimal) signs of ischemia/necrosis, and if the patient is not septic/peritonitic [25]. In case of major leakage with severe mediastinitis/peritonitis, take-down of the anastomosis or establishment of a controlled fistula are available surgical options [1, 14, 18, 25].
- *Extent of anastomotic disruption and condition of tissue:* Defects larger than 2 cm or one third of the circumference are usually not suitable for endoscopic treatment [1, 14, 24, 26, 27]. Anas-

tomosis usually has to be taken down, sometimes followed by direct re-fashioning [24]. Alternatively, diversion needs to be taken into consideration, with restoration of intestinal continuity at a later date [1, 24].

Outcome

Re-suturing or re-fashioning of anastomosis often leads to poor results [17, 26], and the risk of leakage recurrence is high [1, 27]. Moreover, surgical re-intervention for leakage after esophagectomy and gastrectomy carries a high risk of morbidity and mortality, and mortality after surgical re-intervention is higher compared to conservative or endoscopic approaches [1, 13, 17, 18, 22, 26–28]. Finally, surgical revision is described to be associated with inferior long-term survival [14]. However, worse outcome after surgical re-intervention may be biased as this approach is normally taken in patients with more severe disease and sepsis, or if conservative treatment fails [1].

Anastomotic Leakage/Pancreatic Fistula after Pancreaticoduodenectomy

Introduction

Despite advances in surgical technique and perioperative care, recent prospective trials [29] still show a perioperative mortality rate of 5.6% in patients undergoing pancreaticoduodenectomy in specialized centers. The nationwide perioperative mortality rate was even higher (7.7%) and did not improve between 2009 and 2013 [30]. The high perioperative mortality is associated with a morbidity of up to 50%, mostly due to procedure-related complications [31]. While anastomotic leakage of the biliary and gastrointestinal anastomosis is exceedingly rare, leakage of the pancreatic anastomosis, i.e. pancreatic fistula, occurs in about 20% in prospective trials [29], and is often associated with life-threatening complications such as intra-abdominal abscess, intra-abdominal bleeding, and sepsis, which causes a high mortality.

Definition of Pancreatic Fistula

In 2005, an international study group of pancreatic surgeons (ISGPF) proposed a consensus definition and clinical grading for postoperative pancreatic fistula [32], which was updated in 2016 [5]. A pancreatic fistula is defined as an amylase drain fluid level more than three times the upper limit of normal amylase on or after postoperative day 3 and initially a biochemical leak. Pancreatic fistula that require a clinically relevant change in management are termed grade B fistula. Grade C fistula encompass the need for reoperation, fistula-related organ failure, or death [33].

Risk Factors for the Development of Postoperative Pancreatic Fistula

There are several validated risk factors which can be used to predict the risk of developing a clinically relevant pancreatic fistula (grade B/C): pancreatic pathology, texture, main pancreatic duct size, intraoperative blood loss, and surgeon experience [29, 34, 35]. Notably, anastomotic technique (pancreatogastrostomy or -jejunostomy) is not among the known risk factors [29]. However, none of these factors allows for the prediction of fistula severity.

Prevention of Postoperative Pancreatic Fistula

Since most of these risk factors are patient-related, it is unlikely that novel pancreatic anastomotic techniques can reduce pancreatic fistula rates. However, changes in perioperative treatment reduced pancreatic fistula rates in prospective randomized trials: Pasireotide, a somatostatin analogue, significantly reduced the pancreatic fistula rate if administered pre- and postoperatively [36]. Moreover, treatment with pasireotide is cost-effective [37]. Postoperative therapy with other somatostatin analogs has not been shown to be effective [38]. Postoperative total parenteral nutrition also reduces the fistula rate compared to early postoperative nasojejunal enteral nutrition [31]. The value of the omission of intraoperative drain placement is currently unclear: It reduced the pancreatic fistula rate in one multicenter trial [39] but led to an increase in morbidity and mortality in another study [40].

Surgical Treatment of Postoperative Pancreatic Fistula

Consensus on the optimal treatment strategy of clinically relevant pancreatic fistula is lacking, and there is no specific treatment available to alter the clinical course. The majority of patients with severe pancreatic fistula can be successfully managed by leaving the intraoperatively placed drains in situ until the fistula resolves and/or by interventional primary catheter drainage. Patients whose condition is progressively worsening after interventional therapy may require a re-laparotomy [41]. Operative management may then consist of redo pancreatic anastomosis, drainage of the pancreatic remnant, or completion pancreatectomy. It is currently unclear which of the operative strategies is the most ideal one [41].

Pancreatic fistula-related intra-abdominal bleeding is often heralded by a sentinel bleeding episode. In half of the patients, it can be successfully treated interventionally. If intervention is unsuccessful, it constitutes a valuable adjunct to operative hemostasis [42, 43].

Disclosure Statement

There are no conflicts of interest for either author.

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