

Anastomotic leakage following resection of the esophagus – Introduction of an endoscopic scoring system

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Abstract

Background

Malignant tumors of the esophagus are the sixth leading cause of cancer-related deaths worldwide. Postoperative leakage of the esophago-gastrostomy leads to mediastinal sepsis, which is still associated with a high morbidity and mortality rate.

The aim of this study was to describe the endoscopic view of the different severity grades of an anastomotic leakage.

Methods

Patients

Between June 2016 and September 2018, 144 patients were operated upon in the Department of Surgery, University of Munich, Germany.

Among these patients, 34 (23.6%) presented with a leakage of the anastomosis.

Endoscopy

In this retrospective analysis the focus is to describe different patterns of leakage of the anastomosis.

Results

We studied 34 patients in whom post-esophagectomy leakage of the anastomosis was detected and treated with an endoluminal vacuum sponge system.

The leakage healed in 26 of 29 patients (success rate 89.7%).

With increasing severity of leakage, the treatment time and the in-hospital mortality correspondingly increased. Furthermore, the incidence of development of a fistula to the tracheobronchial system increased with higher grades of leakage.

Conclusions

Exact descriptions of leakage are necessary to compare the cases and to prove post-treatment improvement. This is, to our knowledge, the first publication to present a leakage grading score in patients after esophagectomy including reconstruction with a gastric tube.

This new grading system needs to be tested in further analyses, with special focus on prospective analysis.

Introduction

Malignant tumors of the esophagus are the sixth leading cause of cancer-related deaths worldwide [1, 2]. The operative procedure in patients with cancer of the esophagus and the esophagogastric junction - a right abdominothoracic esophagectomy with intrathoracic anastomosis and two field lymphadenectomy – is still demanding due to a high morbidity and mortality rate. Postoperative leakage of the esophago-gastrostomy leads to mediastinal sepsis, which is still associated with a high morbidity and mortality rate; morbidity rates of up to 73% are reported [3, 4]. Furthermore, a hospital mortality of up to 9.6% is reported [3, 5]. A recent meta-analysis, which included the data of 11368 patients with esophageal cancer, revealed a significant correlation of postoperative anastomotic leakage with a decreased 5-year survival as well as with a decreased 5-year disease-free survival [6]. One major factor contributing to morbidity as well as mortality is leakage of the anastomosis, which is reported in up to 23% of cases [3, 5, 7, 8]. In addition, anastomotic leakage after resection of the esophagus or the esophagogastric junction has a significant negative effect on long-term survival [5, 6].

However, what exactly can be termed a leakage of the esophago-gastric anastomosis? There is still no clear definition; especially, no gradation is available. To compare different patient collectives and to define the best treatment standards for different degrees of anastomotic leakage, a pragmatic and clear definition is needed.

Furthermore, the best method to detect a leakage is still under discussion [9].

Additionally, the appropriate treatment of an anastomotic leakage following esophagectomy is still being debated. Vacuum-assisted closure is a method first described in 2008 by Wedemeyer et al [10]. Several reports have investigated the treatment of anastomotic leakages using this system; success rates up to 88% are reported [8, 11, 12].

The aim of this study was to define a leakage of the esophago-gastric anastomosis by using endoscopy and to describe the endoscopic view of the different severity grades of an anastomotic leakage.

Patients And Methods

Patients

Between June 2016 and September 2018, 144 patients were operated upon in the Department of Surgery, University of Munich, Germany. Among these patients, 34 (23.6%) presented with a leakage of the anastomosis; a vacuum-assisted closure system was used to treat the leakage in these patients. Eight patients had squamous cell cancer of the esophagus, 25 had adenocarcinoma of the distal esophagus, and one had achalasia. In 26 patients (76.5%), neoadjuvant treatment was used (14 patients received only chemotherapy before operation, while 12 received combined radio-chemotherapy). The study was performed according to the guidelines of the Declaration of Helsinki; every included patient gave written informed to publish data in an anonymous matter.

Operative procedure

The first operative step is the incision of the upper epigastrium for mobilization of the stomach, followed by the formation of a gastric tube along the greater curvature. Lymphadenectomy along the celiac axis and parapancreatic region is performed. Then, abdominotransthoracic en bloc esophagectomy is done through a right transthoracic approach, including lymphadenectomy in the upper mediastinum. The reconstruction of the intestinal passage is finished with an esophagogastrostomy using the circular stapling method [13]. After esophagectomy, endoscopy was performed in cases where signs indicating possible leakage, such as fever or a change in the drainage fluid, were noted.

Endoscopy

In this study, the endoscopic view in the postoperative course after esophagectomy and reconstruction with gastric tube is presented. The focus is to describe different patterns of leakage of the anastomosis. The analysis is retrospective.

First, the anastomosis is described clockwise: the 12 o'clock position on the endoscopic view is the localized ventral (retrosternal) aspect of the anastomosis; at the 3 o'clock position, the inverted blind stump is located; and at the 6 o'clock position, the dorsal part of the anastomosis is located. Figure 1a shows a normal healing of the anastomosis on day 6 after operation.

Table 1 provides an overview of the examined data.

Table 1: endoscopic view of the anastomosis and the tubular stomach

	appearance
leakage	12-3 o'clock quadrant
	3-6 o'clock quadrant
	6-9 o'clock quadrant
	9-12 o'clock quadrant
tubular stomach	rosy
	necrotic mucosa
	necrotic wall
dehiscence	without cavity
	with cavity
anastomosis	rosy
	partial necrotic < ¼ circumference
	necrotic > ¼ circumference
	necrotic whole circumference

If dehiscence of the anastomosis is detected, its location and size are both documented. If a cavity is present, its presence is noted and its dimensions, including depth, are mentioned. The mucosa and the gastric tube wall are checked for signs of perfusion or necrosis. If there is necrotic and / or fibrotic tissue in the anastomotic region and dehiscence of less than a quadrant of the circumference is detected, a grade 1 leakage is diagnosed. This grade is furthermore separated into grade 1 a and 1 b, respectively. Grade 1a (Figure 1b) is diagnosed if anastomosis is present without a cavity; in case of a leakage less than a quarter of the circumference with a cavity, grade 1b is diagnosed (Figure 1c).

Grade 2 is diagnosed if dehiscence of the anastomosis exceeds a quarter of the circumference (Figure 1d). If necrosis is seen in the mucosa of the gastric tube, grade 3 is diagnosed (Figure 1e), whereas grade 4 is diagnosed if necrosis of the tubular stomach is detected (Figure 1f). Using this exact description and localization of the dehiscence, it is possible to compare the results of the following endoscopic examinations.

In our analysis, the different grades lead to different treatment options. In patients with leakage of grade 1a and 1b, the sponge was placed into the lumen of the esophagus and tubular stomach, respectively. In patients with grade 2 leakage, the vacuum system was placed into the cavity after wound debridement. In patients with grade 3 leakage, the sponge was placed into the lumen of the tubular stomach. In patients with grade 4, reoperation is mostly considered; if this is not possible due to the patient's condition, an endoluminal vacuum treatment is applied. Figure 2 presents an algorithm that is used to determine where the sponge should be placed: in the lumen of the gastric tube or in the cavity.

Table 2 provides a grading system that takes all the above-mentioned parameters into account to show the severity of the leakage. For every severity grade, an endoscopic graph is included to clarify the description, as well as an endoscopic figure of an anastomosis.

Table 2: grade of leakage and endoscopic appearance

grade	dehiscence of anastomosis	cavity	tubular stomach
1a	< ¼ of the circumference	no	rosy
1b	< ¼ of the circumference	yes	rosy
2	> ¼ of the circumference	yes	rosy
3	yes / no	yes / no	necrotic mucosa

Statistical analysis

Statistical analysis was performed using SPSS software, version 25 (SPSS Inc., Chicago, IL, USA). Results are displayed in median [with lower and upper quartile]. For testing significant differences between the examined groups, we used Student's t-test and the Mann-Whitney U test. A significance level < 0.05 was used.

Results

Between June 2016 and August 2018, in the Department of Surgery, University of Munich, 34 patients presented with a leakage of the anastomosis after esophagectomy with reconstruction with a gastric tube, in whom a vacuum-assisted closure system was used. No fistulae were detected on the initial endoscopic examination after operation.

The median day of detection of the leakage was day 6 after the operation (5/9 lower/ upper quartile). During the postoperative course, 5 (14.7%) patients died. The data of these patients were excluded from further analysis.

To present the different clinical courses of the patients depending on the scoring system, the data are presented for every severity grade in detail.

Grade 1a

Twelve patients presented with leakage of grade 1a severity. In these, the sponge was placed into the esophageal lumen and tubular stomach and was changed after two to three days. The in-hospital mortality was 8.3%. The median number of days of treatment with the vacuum system was 15 (9/31 lower/upper quartile). The clinical success rate was 100% (11/11). In 8 patients (72.7%), only the sponge treatment was treatment with regard to the leakage. In 2 patients (18.2%), after extracting the sponge, a clip was applied. In one patient, a self-expanding stent was used after the sponge treatment; the stent was removed 4 weeks later.

In all cases, an endoscopic check as well as a contrast swallow radiograph was performed to determine treatment success.

Grade 1b

Ten patients presented with leakage of grade 1b severity. In these patients, the sponge was placed into the esophageal lumen and tubular stomach and was changed after two to three days. The in-hospital mortality reached 10% in grade 1 b (1/10).

The median number of days of treatment was 25 (14/35 lower/upper quartile). The success rate in grade 1b was 88.9% (8/9). One patient developed a fistula to the tracheobronchial system. In 4 patients (44.4%), the leakage healed with the endoluminal sponge treatment; in 2 patients, a self-expanding stent was applied (22.2%); and in 2 patients, a clip was used to close the leakage after treatment with the endoluminal vacuum system (22.2%).

Grade 2

In 8 patients with a dehiscence of the anastomosis $> \frac{1}{4}$ circumference with an existing cavity, the sponge was placed into the cavity after the cavity was debrided. One patient (12.5%) died within thirty postoperative days.

The median treatment period was 27 days (18/34 lower/upper quartile). The success rate in grade 2 was 71.4 % (5/7); in 4 patients (57.1%), the leakage healed with the endoluminal sponge treatment, while in 1 patient, a self-expanding stent was used after extraction the sponge. Two patients developed a fistula to the tracheobronchial system during the postoperative course

Grade 3

Two patients presented with grade 3 leakage. The vacuum-assisted closure system was placed into the lumen in both patients. During the postoperative course, one of these patients died.

Grade 4

Two patients were classified as having grade 4 leakage; both were treated with an endoluminal placed vacuum-assisted closure system. One patient died within 30 days postoperatively.

Discussion

Anastomotic leakage after esophagectomy with reconstruction with a tubular stomach remains a severe complication with a high risk for mortality and morbidity. This is, to our knowledge, the first publication in which the leakage is described with different severity grades as determined based on the endoscopic view.

We studied 34 patients in whom post-esophagectomy leakage of the anastomosis was detected and treated with an endoluminal vacuum sponge system. The overall mortality rate was 14.7% (5/34); the data of these patients were excluded from further analyses. Table 3.

Table 3: severity of leakage

grade	patients N	periop. mortality % (N)	development of fistulae % (N)
1a	12	8.3 (1)	0 (0)
1b	10	10 (1)	10 (1)
2	8	12.5 (1)	25 (2)
3	2	n.d. (N= 1)	n.d. (N= 1)
4	2	n.d. (N= 1)	n.d. (N= 0)

with increasing grade of leakage the development of a fistula to the tracheobronchial system was increasing

n.d.: not done

The leakage healed in 26 of 29 patients (success rate 89.7%). In 16 (61.5%) patients, the sponge system alone was successful, while in 6 (23.1%), a self-expanding stent was used after treatment with the sponge. In the remaining 4 (15.4%) patients, a clip was applied. A contrast swallow proved the success of the treatment in all patients.

Due to a small number of patients in the grade 3 and 4 categories, we compared the following data only in groups 1a, 1b, and 2. With increasing severity of leakage, the treatment time and the in-hospital mortality correspondingly increased. As the leakage grade increased, the healing success rate decreased: in grade 1a cases, the success rate was 100%, which reduced to 88.9% in grade 1b and 71.4% in grade 2. Furthermore, the incidence of development of a fistula to the tracheobronchial system increased with higher grades of leakage. Table 4.

Table 4: severity of leakage with duration of treatment

grade	patients N	median duration of treatment (days)	healing of leakage % (N)
1a	11	15 (9/31)	100 (11)
1b	9	25 (14/35)	88.9 (8)
2	7	27 (18/34)	71.4 (5)
3	1	n.d. (N=1)	n.d. (N=1)
4	1	n.d. (N=1)	n.d. (N=1)

median treatment duration including lower/upper quartile and succesrate (N= 29) are demonstrated. Patients who died during postoperative course are excluded.

n.d.: not done

Conclusions

Anastomotic leakage following esophageal cancer resection remains a crucial problem and early detection and treatment is important. An exact description of the leakage is necessary to compare the cases and to prove post-treatment improvement. This is, to our knowledge, the first publication to present a leakage grading score in patients after esophagectomy including reconstruction with a gastric tube.

This new grading system needs to be tested in further analyses, with special focus on prospective analysis.

Declarations

- Ethics approval and consent to participate

The ethics vote was given by the ethics commission of Klinikum rechts der Isar Munich according to the guidelines. Every patient gave informed consent to present data in an anonymous form.

- Consent for publication

Every patient gave informed consent to publish data in an anonymous form.

- Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on request.

- Competing interests

None of the authors has a conflict of interest to declare.

- Funding

No sources of funding to declare.

- Authors' contributions:

J.B. designed the study. J.B., M.F., M.A. and C.S. performed the practical part of the study, in addition to the statistical analysis of the data together with M.M. J.B. drafted the manuscript and all authors were engaged in the manuscript work. J.B., M.M. and H.F. have primary responsibility for the final content. All authors have read and approved the final manuscript.

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- Authors' information (optional).

Not applicable for that section.

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Figures

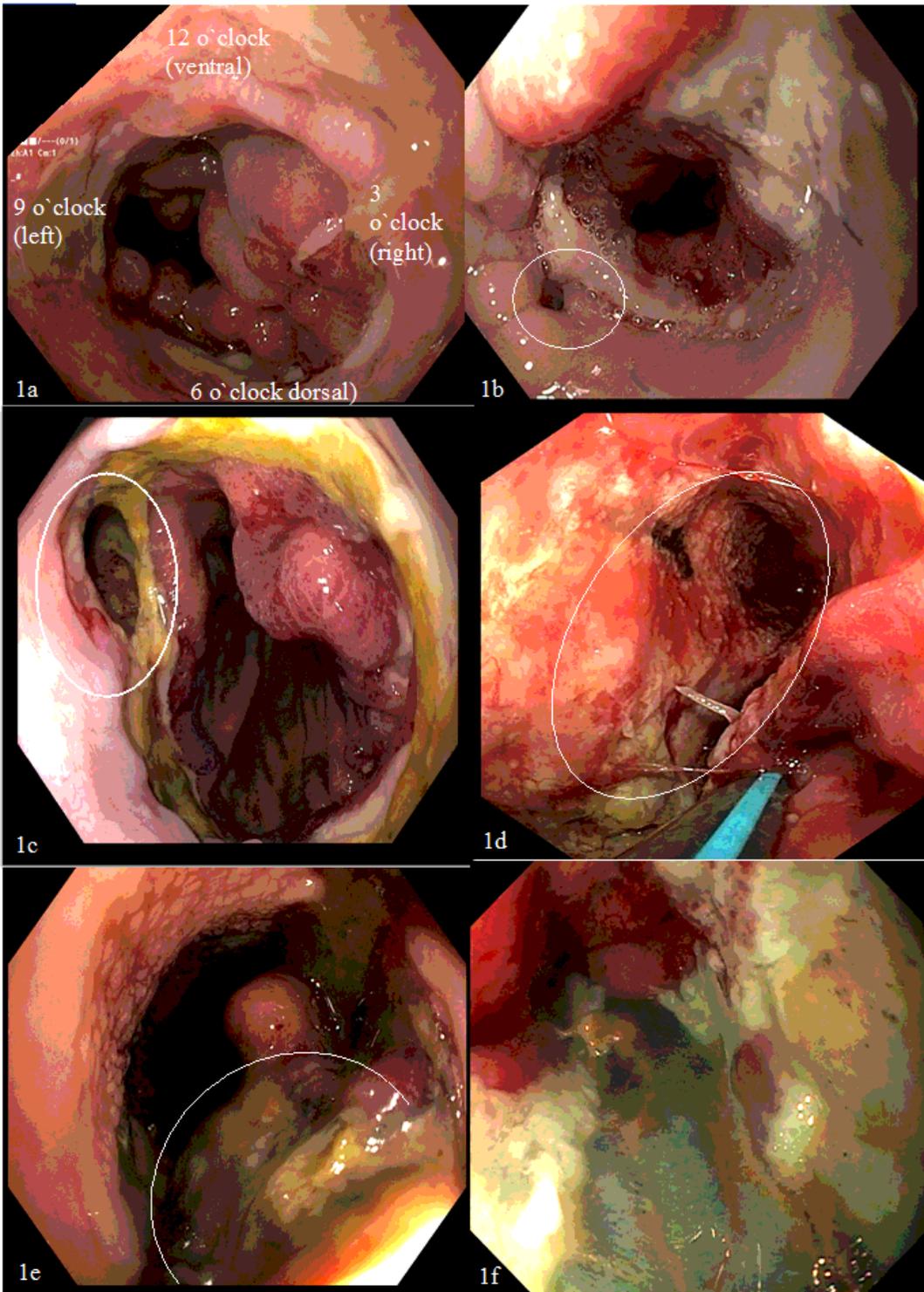


Figure 1

1a: anastomosis on day 6 after operation 1b: leakage grade 1a: dehiscence of the anastomosis less than $\frac{1}{4}$ of the circumference without cavity 1c: leakage grade 1b: rosy tubular stomach, dehiscence of the anastomosis less than $\frac{1}{4}$ of the circumference, with cavity 1d: leakage grade 2: rosy tubular stomach, dehiscence of the anastomosis more than $\frac{1}{4}$ of the circumference, with cavity 1e: leakage grade 3: necrotic mucosal layer of tubular stomach 1f: leakage grade 4: necrotic wall of tubular stomach

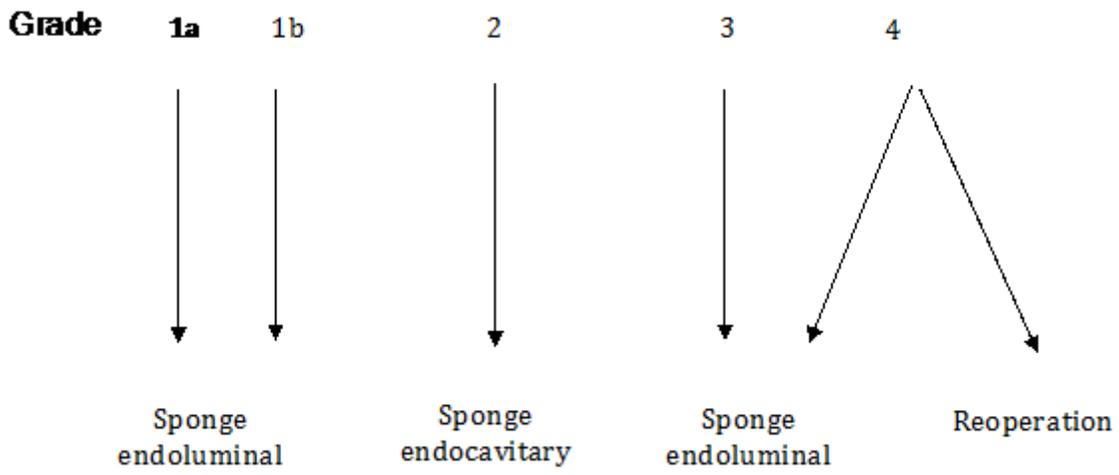


Figure 2

algorithm: detection of leakage severity and recommended treatment