

Esophageal Perforation: Clinical Patterns and Outcomes from a Patient Cohort of Western Norway

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Key Words

Esophageal perforation · Incidence · Treatment · Mortality

Abstract

Background: Esophageal perforation is a rare, often life-threatening condition, and management remains challenging. **Methods:** Retrospective review of consecutive patients with esophageal perforation treated at two university hospitals between 2000 and 2010. Pertinent data from hospital records were retrieved for statistical calculations and evaluation of perforation score. **Results:** Forty-seven patients [47% female, median age 62 years (range 15–88)] were included. The annual incidence was 4.7/1,000,000. Perforations were spontaneous in 14 patients (30%), iatrogenic in 25 (53%), and caused by trauma and foreign body impaction in 8 patients (17%). ASA score ($p = 0.004$), perforation localization ($p = 0.001$), diagnostic delay ($p = 0.002$), and perforation score ($p < 0.001$) differed significantly between patient groups with different etiology, but not between groups with different outcomes. Early diagnosis (≤ 24 h) was significantly associated with a low perforation score ($p = 0.033$). A non-operative approach was employed in 26 patients (55%) – more commonly for proximally localized perforations ($p = 0.045$). The non-operative group showed lower severe com-

plication rates ($p = 0.033$), shorter ICU stays ($p < 0.001$) and durations of mechanical ventilation ($p = 0.022$). The overall 30-day mortality was 23.4%. **Conclusion:** Careful clinical evaluation and appropriate, individualized treatment are important. The high mortality may be partly explained by the underlying disease and the complexity of the clinical condition in many patients.

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Introduction

Management and clinical decision making in patients with suspected esophageal perforation remain a challenge. Esophageal perforation is a potentially life-threatening condition, with reported mortality rates of between 20 and 40% in historical series from Norway [1] and from elsewhere [2]. Very low annual incidences of between 3–6/1,000,000 were recently published from studies in Iceland [3] and Denmark [4]. Prospective randomized trials with appropriate statistical power are not available due to the rarity of this condition, so the core knowledge is provided from various retrospective institutional [5–12] or community-based series [3, 4, 13]. Patients with spontaneous perforation of a healthy esophagus (Boerhaave syndrome [14, 15]) represent a subgroup of par-

ticular concern [16]. Heterogeneity with regard to study populations, diagnostic work-up, and applied treatments makes comparisons difficult. Due to the lack of consensus and the obviously very limited personal experience that most health care personnel have with this emergency, case management is largely influenced by the surgeon's experience, judgment, and treatment policy, as well as the resources of the responsible department [17, 18]. The clinical condition presented at admission and the primary clinical evaluation of patients with esophageal perforation may vary extensively, particularly as imaging techniques improve and the diagnostic and therapeutic toolbox expands [19] with the development of endoscopic or percutaneous approaches to diagnose and drain collections that previously had to be treated surgically.

The purpose of this paper was to analyze demographics, diagnosis, and treatment of consecutive patients with esophageal perforation treated at the two referral centers that cover a population of almost 1,000,000 people of Western Norway. In addition, we wanted to evaluate the feasibility and possible clinical advantages of using the clinical perforation score, as recently introduced by Abbas et al. [5], in our series of patients with esophageal perforations.

Patients and Methods

The Haukeland University Hospital and the Stavanger University Hospital cover a catchment area of about 1,000,000 people, and all esophageal perforations from this area are treated at these hospitals. Eligible patients were identified by electronic search for the diagnosis of esophageal perforation among appropriate ICD-9 and ICD-10 codes (K22.3, S27.8, T28.1, T28.6) in the hospital databases; additional searches were done by cross-searching among relevant procedure codes. Hospital records, including surgical notes and descriptions from endoscopic procedures and imaging, were reviewed and data was recorded in an electronic database. Information was retrieved regarding demographics and clinical characteristics (ASA score and comorbidity), and whether any esophageal pathology was known prior to the perforation (esophageal pathology, esophageal stricture, achalasia, malignant tumor, or other conditions). We also recorded the etiology of the perforation (spontaneous, iatrogenic, or other), diagnostic and therapeutic aspects of the management, and outcomes. Localization of the perforation was classified as cervical, thoracic, or distal/abdominal (i.e. the gastro-esophageal junction). All available information was used to calculate the estimated time period (in hours) from onset of the first symptoms or signs of a perforation to a confirmed diagnosis.

As suggested by Abbas et al. [5], a perforation severity score (range 0–18) at the time of presentation was calculated based on clinical variables and findings on imaging. Points were given for each variable (table 1).

Table 1. Clinical perforation score according to Abbas et al. [5]

Variables	Points
Age >75 years	1
Tachycardia (>100 bpm)	1
Leukocytosis (> 10,000 WBC/ml)	1
Pleural effusions (on chest X-ray, CT or barium swallow test)	1
Fever (>38.5°C)	2
Non-contained leak (on barium swallow test or CT)	2
Respiratory compromise (respiratory rate >30/min, increasing oxygen requirement, or need for mechanical ventilation)	2
Time to diagnosis >24 h	2
Presence of cancer	3
Presence of hypotension at admission	3

Clinical perforation score adds up, according to variables that apply, to maximal 18 points.

Complications were recorded based on all available information from hospital records, including consecutive daily notes for patients admitted to the ICU, and pertinent information from imaging and endoscopic examinations. As suggested by Dindo et al. [20], complications were categorized and graded for severity as follows: grade I–II complications do not require any intervention; grade IIIa+b require surgical, endoscopic, or radiological intervention (grade IIIb if general anesthesia is necessary); grade IV are life-threatening complications (IVa applies to a single-organ dysfunction; IVb when multi-organ dysfunction occurs), and grade V refers to the death of a patient.

Study Ethics

The study was approved as a quality control assurance study by the institution's review board (ID No. 169), according to general guidelines provided by the Regional Ethics Committee.

Statistics

SPSS 19.0 for Mac (SPSS Inc., Chicago, Ill., USA) was used for statistical analysis. A non-parametric distribution of data was assumed, and χ^2 or Fisher's exact test was used for dichotomous data where appropriate. The Mann-Whitney U test was used for comparisons of continuous data between two groups, and the Kruskal-Wallis test was applied when more than two groups were compared. All tests were two-tailed, and statistical significance was set at a p value <0.05.

Results

Patients and Clinical Characteristics

Forty-seven patients (53% males), with a median age of 62 years (range 15–88), were diagnosed with esophageal perforations between 2000 and 2010. No significant differences were seen between genders with regard to de-

Table 2. Characteristics and outcomes according to cause of perforation

Variable	Spontaneous n = 14 (30%)	Iatrogenic n = 25 (53%)	Other ¹ n = 8 (17%)	p value
Gender, M:F	4:10	11:14	5:3	0.231
Median age, years (range)	63 (47–80)	61 (15–89)	57 (22–81)	0.838
ASA score				
1	0	4 (16)	2 (25)	0.004
2	2 (14)	13 (52)	4 (50)	
3	10 (72)	8 (32)	0	
4	2 (14)	0	2 (25)	
Localization				
Cervical	0	4 (16)	6 (74)	0.001
Thoracic	7 (50)	11 (44)	1 (13)	
Distal/GEJ	7 (50)	10 (40)	1 (13)	
Median time to diagnosis, h (range)	88 (4–178)	20 (0–200)	42 (2–95)	0.002
Clinical perforation score ² (range)	6 (2–14)	5 (0–9)	5 (0–12)	<0.001
Clinical perforation score category ²				
≤2	1 (7)	7 (28)	1 (13)	0.289
3–5	5 (36)	9 (36)	5 (62)	
>5	8 (57)	9 (36)	2 (25)	
Surgically treated	6 (43)	11 (44)	4 (50)	0.944
Median ICU stay, days (range)	1 (0–38)	1 (0–41)	0 (0–10)	0.418
Days on ventilation, median (range)	0 (0–16)	0 (0–15)	0 (0–8)	0.936
Days of hospitalization, median (range)	17 (5–110)	22 (1–58)	14 (1–58)	0.815
In-hospital mortality	7 (50)	5 (20)	1 (13)	0.076
30-day mortality	6 (43)	4 (16)	1 (13)	0.119

Values are numbers (%), unless otherwise indicated. GEJ = Gastro-esophageal junction.

¹ Including food impaction (n = 3), multi-trauma patients (n = 3), and swallowing part of a denture or foreign bodies (n = 2). ² According to Abbas et al. [5].

mographics and basic clinical characteristics. One-third of the patients (36%) had no known pathology of the esophagus prior to the perforation. A cervical localization of the perforation was encountered in 10 patients (21%), thoracic in 19 (41%), and distal in 18 (38%). Malignancy related to the esophagus was reported in 8 patients (17%). Of note, a significant trend (p = 0.006) for proximal location was found when the cause of perforation was a benign stricture, or when no esophageal pathology was evident prior to the perforation.

More than half of the patients (n = 24; 51%) were diagnosed with esophageal perforation within the first 24 h from symptom onset, 62% were diagnosed within 48 h, and overall 70% of the patients had perforation confirmed within 72 h. The remaining 13 patients were diagnosed between 95 and 200 h from symptom onset. Demographics and outcomes did not differ significantly between those diagnosed early (≤24 h) and those diagnosed later.

The general occurrence of esophageal perforations diagnosed during the study period translates into an es-

timated incidence of 4.7/1,000,000 per year, considering the catchment area and the population of the two hospitals.

Characteristics and Outcomes according to Cause of Perforation

Clinical characteristics and outcomes according to cause of perforation are displayed in table 2. The spontaneous perforation group comprised 6 patients with true Boerhaave syndrome [14], and 8 patients with spontaneous perforations related to various conditions, including malignant esophageal tumors (with or without a stent in place), infections or fistula, or suggested esophageal ischemia or inflammation. The cause of perforation was categorized as iatrogenic when the perforation occurred in relation to diagnostic (e.g. endoscopy or placement of a gastric tube; n = 7) or therapeutic [e.g. surgical repair of a para-esophageal hernia (n = 6) or dilatation of a benign stricture (n = 8), related to cervical spine surgery (n = 2) or therapeutic procedures with a non-flexible scope (n = 2)] procedures. Other causes of perforations included

perforations related to food impaction ($n = 3$), or encountered in multi-trauma patients ($n = 3$), or after swallowing part of a denture or other foreign bodies ($n = 2$).

While ages were similar between groups, significant differences in the ASA score ($p = 0.004$) indicate that general health was more compromised in patients with a spontaneous perforation. In addition, a distal localization of the perforation was significantly more common in the group with a spontaneous perforation ($p = 0.001$). Time from symptom onset to diagnosis varied between groups, with a significantly longer delay in patients with spontaneous perforation ($p = 0.002$).

We compared the clinical perforation score [5] between groups; in spite of rather similar median values, significant differences between groups were observed ($p < 0.001$) (table 2). However, no significant differences were encountered when distributions of severity categories of each perforation cause were compared between groups.

Imaging and Work-Up

Diagnostic imaging was done by esophagography with oral contrast in 20 patients (43%), resulting in confirmation of a perforation in 13 (65%) of these patients, a negative examination in 6 patients (30%), and an indefinite conclusion for 1 patient. A computer tomography (CT) examination was performed in 38 (81%) of the patients, with confirmation of a contrast leakage obtained in 23 (61%). CT results additionally confirmed or supported a suspected clinical esophageal perforation in 33 (87%) of these patients by showing indirect signs of esophageal injury – including a recognition of mediastinal air in 6 (16%) and pneumoperitoneum in 4 (11%) of the examined patients. A negative CT was reported in 2 patients (4%), and 2 patients had an indefinite imaging. A CT was not included in the primary diagnostic work-up in 9 (19%) of the patients. An upper endoscopy was done in 37 (79%) of the patients, with a perforation confirmed in 20 (54%) of these examinations. Uncertain or suspicious findings were reported in 6 patients (16%), 9 patients (24%) had other miscellaneous endoscopic findings, and a negative endoscopy was encountered in 2 (5%) of the patients. Throughout the study period, the use of endoscopy remained virtually unchanged, but there was a trend of esophagography being replaced by CT imaging ($p = 0.021$) for the primary diagnostic work-up of these patients.

Management

An operative approach was employed in 45% of the patients, with no differences observed with regard to cause of perforation (table 3). A non-operative approach

was more common in patients with a cervical or thoracic localization of the perforation ($p = 0.045$). Otherwise, no significant differences related to the therapeutic approach were seen with regard to demographics and clinical presentation. Surgery included a thoracotomy with drainage in 6 patients (14%), thoracotomy with suture of the esophagus in 5 (12%), esophageal resection in 3 (7%), laparotomy + esophageal suture in 4 (9%), and cervical incision and drainage in 2 (5%). Additionally, various endoscopic (endoscopic stent, endoscopic transluminal drainages, placement of feeding tubes) or percutaneous interventions (i.e. ultrasound-guided drainage of effusions and/or abscesses) were performed, sometimes repeatedly, in 9 patients (20%), who were not otherwise surgically treated. In 16 patients (36%), no specific interventions or operations were applied.

The proportion of patients with severe or life-threatening complications (Clavien-Dindo grade III–V) was significantly higher in the surgically treated group. The surgically treated patients also experienced a significantly ($p < 0.001$) longer stay in the ICU, and a significantly ($p = 0.022$) longer time on ventilation. However, hospitalization times and 30-day mortality were similar for both groups.

Clinical Perforation Score

When patients were categorized into three risk groups according to their clinical perforation score at presentation (as suggested by Abbas et al. [5]) no differences were observed with regard to demographics (table 4). However, when evaluating diagnostic delay versus clinical perforation score category, we observed that the proportion of patients with an early diagnosis (<24 h) was significantly higher ($p = 0.033$) in the lower risk group (87%) as compared to the middle (37%) and higher (47%) risk groups. This did not translate into significant differences regarding main outcomes, including ICU stay or 30-day mortality.

General Outcomes

The 30-day mortality was 23.4% (11/44) and the total in-hospital mortality was 27.7% (13 deaths in total). Causes of death included sepsis and multi-organ failure ($n = 9$), chronic obstructive respiratory disease ($n = 2$), aspiration ($n = 1$), and advanced malignant disease ($n = 1$). The causes of death were mostly determined based on clinical evaluation; autopsy was performed in only 4 patients (31%). In a number of patients whose clinical evaluation suggested death from multi-organ failure, significant comorbidity (including malignant disease, alcoholism, or obvious cardio-respiratory incapacity) should be recognized as important cofactor for the detrimental outcome.

Table 3. Characteristics and outcomes after non-operative or operative treatment

Variable	Non-operative n = 26 (55%)	Operative n = 21 (45%)	p value
Gender, M:F	13:13	13:8	0.425
Median age, years (range)	63 (15–88)	62 (22–87)	0.732
ASA score			
1	3 (12)	3 (14)	0.171
2	14 (54)	5 (24)	
3	8 (31)	10 (48)	
4	1 (3)	3 (14)	
Localization of perforation			
Cervical	6 (23)	4 (19)	0.045
Thoracic	14 (54)	5 (24)	
Distal/GEJ	6 (26)	12 (57)	
In-hospital perforation	10 (39)	8 (38)	0.980
Perforation cause			
Spontaneous	8 (31)	6 (29)	0.944
Iatrogenic	14 (54)	11 (52)	
Other	4 (16)	4 (19)	
Median time from perforation to diagnosis, h (range)	27 (0–200)	21 (0–178)	0.514
Presentation			
Early <24 h	13 (50)	11 (52)	0.871
Late	13 (50)	10 (21)	
Complication severity grades I–V ¹			
I minor	2 (8)	1 (5)	0.033
II pharmacologic treatment	7 (27)	1 (5)	
III intervention	11 (61)	7 (33)	
IV life-threatening	1 (4)	5 (24)	
V death	5 (11)	7 (33)	
Median ICU stay, days (range)	0 (0–41)	6 (0–38)	<0.001
Days on ventilation, median (range)	0 (0–15)	1 (0–16)	0.022
Days of hospitalization, median (range)	15 (3–58)	27 (1–110)	0.166
30-day mortality	6 (23)	5 (24)	0.953

Values are numbers (%), unless otherwise indicated. GEJ = Gastro-esophageal junction. ¹ According to Dindo et al. [20].

Discussion

Our estimated annual incidence of 4.7 esophageal perforations per population of 1,000,000 is largely in concert with previous reports from Iceland and Denmark [3, 4]. The demographics of our population are also comparable with those reported from other Nordic countries [3, 4, 13], Europe [10], and the USA [5]. The younger age of patients encountered in other parts of the world reflects a difference in etiologies of esophageal perforation. In India, perforations after dilatation of corrosive strictures constitutes the major etiology, and the average patient is at least 20 years younger than most patients encountered in the Western world [6].

The rather low proportion of patients diagnosed with a spontaneous perforation (i.e. true Boerhaave syndrome)

in this study is in contrast to previously reported rates of between 30–37% [5, 13]. These variations may be partly explained by different case mixes, varied referral patterns, as well as a different understanding of the definition of a true Boerhaave syndrome; for example, in this study we did not consider a ‘spontaneous’ esophageal perforation caused by peri-esophageal malignancy to be a true Boerhaave syndrome.

We observed 3 multi-trauma patients with esophageal perforation after blunt injury. Although rarely encountered, and seldom considered in most series, trauma is a well-known cause of esophageal perforation [21].

About half of our patients experienced a diagnostic delay (at least 24 h from symptom onset), which is comparable with findings of a recent study on spontaneous perforations [22], as well as with those of other reports on

Table 4. Characteristics and outcomes according to clinical perforation score¹

Variable	Clinical perforation score ¹			p value
	≤2 n = 9 (18 %)	3–5 n = 19 (41%)	>5 n = 19 (41%)	
Gender, M:F	6:3	9:10	11:8	0.605
Median age, years (range)	63 (31–87)	63 (15–89)	62 (28–82)	0.171
ASA score				
1	1 (12)	3 (16)	2 (10)	0.753
2	4 (44)	9 (47)	6 (32)	
3	4 (44)	6 (32)	8 (42)	
4	0	1 (5)	3 (16)	
Perforation cause				
Spontaneous	1 (11)	5 (26)	8 (42)	0.289
Iatrogenic	7 (78)	9 (48)	9 (47)	
Other	1 (11)	5 (26)	2 (11)	
Presentation				
Early ≤24 h	8 (89)	7 (37)	9 (47)	0.033
Late	1 (11)	12 (63)	10 (53)	
Median ICU stay, days (range)	0 (0–10)	1 (0–39)	3 (0–41)	0.418
Days on ventilation, median (range)	0 (0–9)	0 (0–16)	0 (0–15)	0.936
Days of hospitalization, median (range)	22 (0–36)	14 (3–110)	28 (1–53)	0.575
Complication severity grades I–V ²				
I minor	0	2 (11)	1 (5)	0.661
II pharmacological treatment	3 (33)	4 (21)	1 (5)	
III intervention	2 (22)	7 (37)	9 (47)	
IV life-threatening	1 (11)	2 (11)	3 (16)	
V death	3 (33)	4 (21)	5 (26)	
30-day mortality	4 (44)	3 (16)	4 (21)	0.235

Values are numbers (%), unless otherwise indicated. ¹ According to Abbas et al. [5]. ² According to Dindo et al. [20].

esophageal perforations of various causes [23, 24]. The reported proportions of patients with a diagnostic delay vary between 25–50% in many series. It has been suggested that the time interval from perforation until confirmed diagnosis is of great importance both for appropriate treatment decisions and for outcomes [25, 26]; however, this importance has been questioned by others [18, 27]. There is some uncertainty regarding the reliability of reported delays in studies that are mostly retrospective.

A clinical score may provide useful information for decision-making and prognostication; it could also help to classify and describe the severity patterns of various patient series, enabling more appropriate comparisons of results and outcomes when various treatment approaches are employed in different series. As recently suggested by Abbas et al. [5], for a perforation score to be clinically useful in the management of patients with esophageal perforations, it must be tested in multiple series for validation. To the best of our knowledge, the clinical score tested in the present

study had not yet been evaluated or validated by others. While several clinical aspects and factors are obviously useful for appropriate evaluation of these patients, it is uncertain why the authors [5] included some variables into their score, and why different weights were attributed to some of the included variables. Furthermore, no statistical models or calculations seem to support the suggested score. In this particular context, such information would be of particular interest, because the current scientific evidence is mostly based on smaller retrospective studies.

In the evaluation of results and the reliability of scores based on retrospective studies, comparisons may be hampered by the fact that detailed clinical information on important aspects or variables may not be available for registration and further evaluation. In most hospitals, including larger referral centers, the rarity of esophageal perforations is evident. Moreover, the diverse patterns of patients' individual health condition and the clinical presentation of this emergency require a careful and thor-

ough evaluation to ensure appropriate diagnostic work-up and management [10, 17, 28]. The majority of patients with iatrogenic perforations are diagnosed immediately or early after the incident, and these patients are already mostly under hospital care. In this particular group of patients, a clinical perforation score is suggested to be very low or zero. A clinical perforation score would be more useful and attractive if additional guidance could be provided in the more complex cases that are frequently encountered in patients with various spontaneous perforations. As for now, it remains uncertain if this score may add any useful information with regard to clinical management and prognostication of patients with esophageal perforation. Nevertheless, application of well-defined criteria on various study populations may provide information, which may partly explain differences in demographics and clinical characteristics of various reports. Differences in case mix may partly explain the range in outcomes.

For evaluation and grading of complications, we used the Clavien-Dindo criteria [20]. These criteria are commonly used for characterization of postoperative complications, and are referred to in many recent publications. However, it remains uncertain if this classification is appropriate in this particular setting, with a heterogeneous study population managed by a variety of treatment modalities. Specifically, it may be difficult to clinically differentiate between a complication or consequence of the perforation, and a complication of the applied treatment. Nevertheless, serious complications requiring appropriate treatments were encountered in the majority of our patients, and the patterns and severity of complications are of relevance in describing the study population, and for comparisons with others.

Several decades ago, Cameron et al. [29] introduced a non-operative approach for select groups of esophageal perforation patients; this approach has received more attention during recent years. Patients included in the present study population have not been treated according to a specific common protocol. Management was mostly guided by interpretation of the current literature, and commonly supervised clinically by fellow surgeons with a particular interest to competence and responsibility for upper GI surgery. The indications for operative treatment were generally a short delay between perforation and diagnosis (less than 24 h), judgment of the patient's comorbidity, and also to some extent the individual evaluation of the clinical setting. In addition, treatment decisions might also have been influenced by qualifications of the attending surgeon on call.

We did not observe any significant changes in case management at our hospitals during the study period, which may partly be explained by the limited time period of 11 years. Of interest, we observed that ultrasound-guided percutaneous drainages or endoscopic transluminal drainages [30] have been more commonly employed during recent years, both as a supplement to surgery, and sometimes instead of operative treatment. It has recently been suggested that a number of contemporary non-operative techniques, including clips [31], stents [32–34], and vacuum therapies [35, 36], be used both as primary treatment for the perforation and as secondary tools when complications occur. These techniques are regarded as feasible and promising; however, the overall clinical experience is limited, and most related publications are case series with very few patients. Further clinical evaluation is necessary to determine the precise role of these tools in the management of these often high-risk patients [19]. Our own results do not allow for firm detailed recommendations regarding the management of this group of patients. Nevertheless, some guidance would be useful in the clinical setting, and algorithms have been suggested. In that respect, we think that the concept outlined by Brinster et al. [37] would be of some relevance. However, based on a recent series from the UK published by Di Franco et al. [38], the treatment of patients with malignant esophageal perforations should receive particular attention. As emphasized by these authors, aggressive surgery in patients with malignant perforations is rarely beneficial, and a non-operative approach is recommended [38]. Although the general limitations of algorithms are well-known, we have tried to merge various considerations put forward by several authors and by Brinster et al. [37] and Di Franco et al. [38] in particular, when we developed an algorithm (fig. 1), which may be of some help in the clinical management of these patients.

The present study was based on consecutive patients referred from a geographically well-defined area with a continuously expanding population of around 900,000 people on average during the study period. Thus, it is a strength of this population-based study that, to the best of our knowledge, the patient series comprised all eligible patients with esophageal perforation in this area. The annual incidence of 4.7/1,000,000, the demographics, and the outcomes were comparable with those recently reported from other Nordic countries [3, 4, 13].

The rarity of this potentially life-threatening emergency is a limitation of this study. As with several previous studies [5, 7, 8, 11, 39], our results were based on a

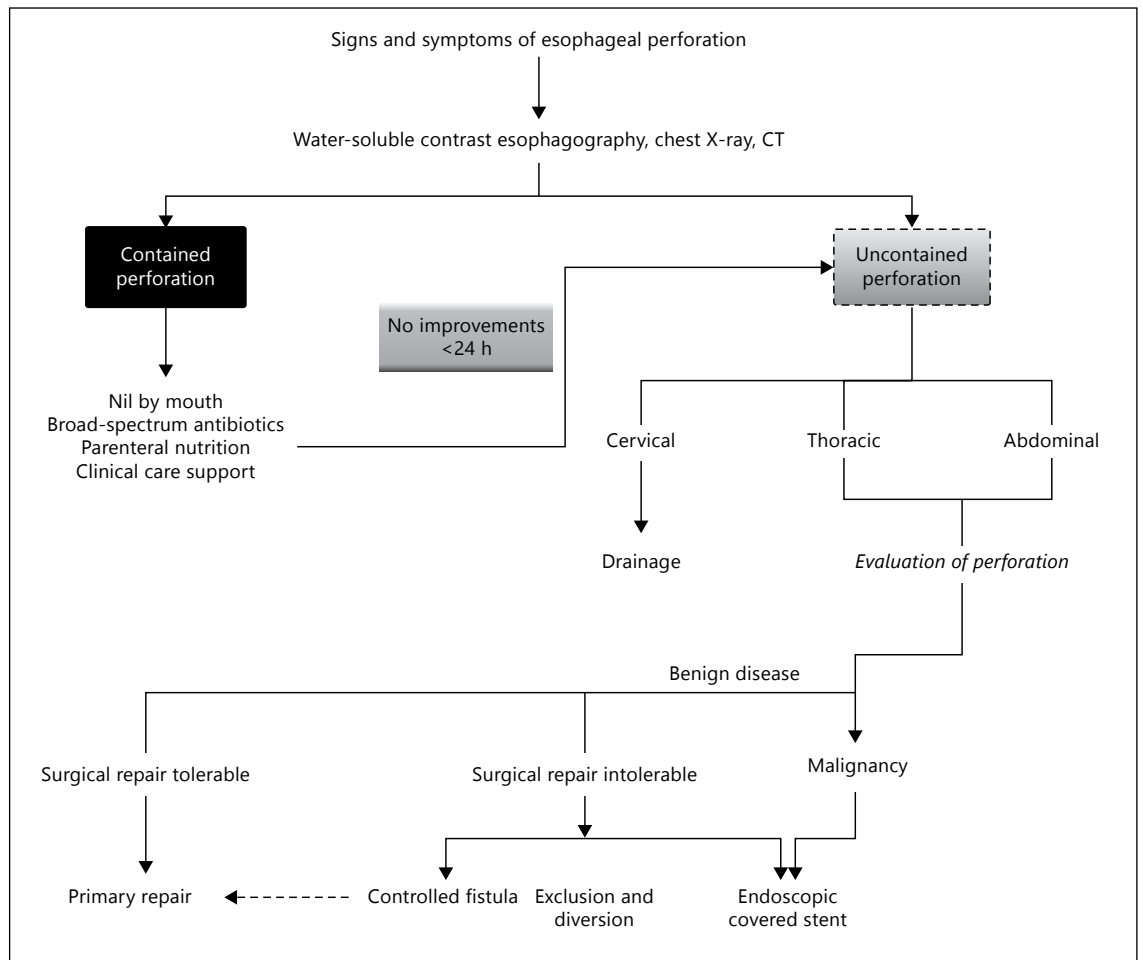


Fig. 1. Evaluation and treatment of esophageal perforation (adapted from [37, 38]).

retrospective evaluation of available data. Morbidity and mortality following esophageal perforation are generally high, although varying between series. We observed a relatively high mortality of 23.6%, and this was mainly related to diagnostic delay, comorbidity and patients with advanced cancers. However, comparing the present figures with previously reported data from other series remains a challenge. Different variables have been included in various studies, and the interpretation and implementation of definitions (e.g. diagnostic delay, leukocytosis, contained leak, respiratory compromise, hypotension, sepsis, and complication) likely differ among many reports [40]. Furthermore, mortality is reported differently, often with less concern about the possible discrepancies of reporting 30-day mortality and in-hospital mortality [5–7]. Consequently, comparisons of results are difficult. However, true prospective (multi-

center) studies are hardly practicable in this context due to the very low patient recruitment over time, and a randomized controlled study would likely be underpowered due to logistic constraints involved in conducting such a study.

This study on 11 years of management of esophageal perforation cases reveals that, while the incidence remains almost the same, and the clinical management of this rare emergency is still a challenge, the diagnostic and therapeutic toolbox is expanding. Substantial morbidity and mortality remain of concern. Detrimental outcomes are likely related to the etiology of the perforation as well as the appropriateness of treatment. Our findings also indicate that general comorbidity and underlying malignant disease commonly encountered in these often fragile patients should be taken into consideration when results from various heterogeneous series are compared.

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