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editorial article

On the need of standards for reporting on esophageal perforation

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SUMMARY: **On the need of standards for reporting on esophageal perforation.**

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Esophageal perforation is associated with significant mortality and morbidity. Its etiology is as heterogenous as modalities currently employed for its treatment. There is no clear evidence which is the treatment of choice for esophageal perforation. This is partly due to the suboptimal quality of available studies and failure to accurately report on the characteristics, treatment and outcome of these patients. Indeed, baseline, operative and outcome data are important for a better evaluation of published data and possibly for including them in meta-analyses of aggregate or individual patient data. We propose a checklist for reporting data on esophageal perforation in order to standardize reporting of data of studies on this severe condition.

KEY WORDS: Esophageal - Oesophageal perforation - Boerhaave - Iatrogenic - Foreign bodies - Caustic - Reporting standards.

Introduction

Esophageal perforation is an infrequent emergency condition characterized by transmural disruption of the esophagus with contamination of the surrounding spaces with oral secretions, ingested food and liquids and gastric contents. This leads to local chemical inflammatory reaction which may cause local necrosis and be complicated by local infection and sepsis. Esophageal perforation is associated with significant mortality and morbidity and usually requires prolonged in-hospital treatment (1). Because of this, prompt recognition and treatment of this condition is advocated. Barrett (2) was the first to report, in 1947, on successful aggressive surgical treatment of esophageal perforation and since then a number of treatment strategies has been developed in order to repair the perforation site and its related local complications. Among less invasive procedures, stent-grafting for esophageal perforation has been recently introduced with some success (3,4), but its benefits are still unproven. Indeed, no treatment strategy has been clearly shown to be superior over the others. This can be in part explained by the large heterogeneity of the causes of esophageal perforation, the timing of diagnosis and treatment as well as the severity of esophageal rupture and the extent of its related local and systemic complications. Patients' comorbidities also may have a significant prognostic role, but have not been adequately investigated.

A recent meta-analysis attempted to summarize the results of current treatment strategies as well as the prognostic impact of baseline characteristics. This study showed that pooled immediate mortality after esophageal perforation was 11.9% (1) and this figure can be much higher as most of studies failed to report on those perforation diagnosed at autopsy (5). Most importantly, this study showed major pitfalls in reporting baseline characteristics, treatment modalities and outcome of these pa-

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tients. Such pitfalls along with the scattered reports of small number of patients may represent a major barrier to the understanding of this severe emergency condition and evaluation of the results of different treatment strategies. In fact, experience of single institutions can be limited as we estimated from 37 studies from single centres a mean rate of esophageal perforation of 3.9 cases per year (range, 1.1-11.9) (1). Consequently, better quality data from large series can lead to a better evaluation of prognosis of these patients and results of different treatment modalities.

Meta-analysis of aggregate data and of individual patient data

Studies on uncommon diseases can benefit from data of multicenter registries, but often such studies can be difficult and expensive to be planned and performed. This may apply also to any multicenter study on esophageal perforation. Complete and accurate reporting of data on patients with this severe condition can be used for a better evaluation of results of single series. However, we believe that this would significantly contribute to the analysis of aggregate data or, even better, of individual patient data (6). In fact, individual patient data meta-analysis enables researchers to investigate the effectiveness of treatment in patients with different profiles. Analysis of individual patients data can be done by grouping all the data across each study into one set and analyze this set as if it is one large study. An alternative two-stage method would be to analyze each study separately, calculate a summary statistic, and compare summary statistics.

Even if data from each patient can be retrieved even after publication of clinical series, we believe that complete report of patients' data in tables at the time of original publication can avoid the difficulties to get unpublished data. This would allow an easy collection of individual patient data and would make data from any report on esophageal perforation, even those from small series, an important contribution for future meta-analyses.

Common data elements and their reporting

Common data elements are needed to ensure that data are defined in the same way and reported thoroughly. This facilitates the standardization of data across registries/series and, importantly, may render possible various analyses and studies of uncommon conditions. This is very important in studies evaluating the outcome of esophageal perforations as, despite a common language has been used in previous studies to define baseline, operative and outcome variables of these patients, there is a lack of reporting on important risk factors and outcome measures, which otherwise are easily retrievable from patients' records. This problem of incomplete data reporting can be overcome by using the herein proposed specific lists of variables of interest in the evaluation of a patient with esophageal perforation (Tables 1, 2).

A narrative description of patients' characteristics, treatment modality and outcome is often used describe patients' characteristics, treatment and outcome after esophageal perforation. We encourage to report important data on these patients in tables published in the main article or as supplementary file. This may help to provide thorough information for critical analysis of the results of single series as well as for aggregate and individual patient data meta-analyses.

Variables of interest in studies on esophageal perforation

Table 1 and 2 summarize a number of variables which may be helpful to better define the baseline risk, the type of procedure and the outcome of patients with esophageal perforation.

Although a large number of comorbidities may contribute to adverse events in these patients, we believe that only a few of them are likely to be prognostic indicators of this severe condition. Meta-regression showed that patients with esophageal perforation with associated esophageal cancer have a significantly higher risk of immediate mortality (1). This may apply also to other esophageal diseases as they may prevent healing of the rupture site or be associated with other severe comorbidities. Renal failure and coronary artery disease are largely recognized as predictors of poor immediate and late outcome after surgery and thus their prognostic role deserves to be evaluated also in patients with esophageal perforation.

TABLE 1 - BASELINE VARIABLES OF INTEREST IN STUDIES REPORTING ON PATIENTS WITH ESOPHAGEAL PERFORATION.

Baseline variables
Age (mean ± standard deviation)*
Gender
Benign esophageal disease (type)
Esophageal cancer (type)
Serum level of creatinine (mean ± standard deviation)*
Coronary artery disease (on-going *angina pectoris* or any previous myocardial revascularization)
History of alcoholism
Severe sepsis (with organ dysfunction, hypoperfusion, or hypotension)
Severe injury of other organs (in case of traumatic perforations)
Characteristics of esophageal perforation
Size of esophageal perforation
Site of perforation (cervical, intra-thoracic, intra-abdominal, cervico-thoracic, thoraco-abdominal)
Etiology of esophageal perforation
Spontaneous perforation (Boerhaave's syndrome)
Other spontaneous perforation (esophageal and extra-esophageal diseases)
Iatrogenic perforation
Endoscopic procedure
Procedures on other organs/structures
Traumatic perforations
Secondary to foreign bodies
Blunt injury
Penetrating injury
Caustic injury

** In order to perform meta-analysis of continuous data, the meta-analysts need the mean value and the variance (or standard deviation) in order to pool data. Data can be reported also in tables for each patient in order to allow individual patient data meta-analysis.*

Alcoholism is often an underlying cause of Boerhaave's syndrome, but its prognostic role has not been evaluated even if it may likely be associated with adverse early and late events. Similarly also presence of severe sepsis, which likely identifies patients with most severe complications of esophageal perforation, may be helpful to stratify the risk of these patients. The same applies to those few patients with blunt or penetrating injuries of the esophagus, in whom associated injuries to other organs may be major contributors of early adverse events.

A systematic review of the literature showed that the site and size of perforation are infrequently and poorly reported (1). There is also lack of data on the incidence and outcome of perforations involving the cervico-thoracic and thoraco-abdominal segments of the esophagus. A more precise description of the involved segment and the extent of perforation are important to better define the severity of the lesion and evaluate its prognostic impact.

One of the major problems with observational studies is the difficulty to understand whether analysis is performed according to the intention-to-treat principle, i.e. analysis based on the initial treatment intent, not on the treatment eventually administered. This is particularly important in the analysis of results of patients with esophageal perforation as they may undergo a number of different invasive procedures to treat failure in esophageal healing or extra-esophageal complications after primary treatment. This is of major importance particularly in the evaluation of benefits and risk related with a policy of less aggressive surgical treatment advocated by a few authors (7,8) or new endoscopic procedures such as stent-grafting (3,4) and clipping (9).

Scarce data exist on the late outcome after esophageal perforation. Collection of data on survival and need of late reinterventions may be useful for evaluation of the late results of any treatment modalities as well as the impact of preoperative comorbidities and esophageal perforation itself on late outcome.

TABLE 2 - OPERATIVE VARIABLES AND OUTCOME END-POINTS OF INTEREST IN STUDIES REPORTING ON PATIENTS WITH ESOPHAGEAL PERFORATION. TREATMENT SHOULD BE REPORTED ACCORDING TO THE INTENTION-TO-TREAT PRINCIPLE (BASED ON THE INITIAL TREATMENT INTENT).

Delay from event to initial treatment
Continuous variable (mean ± standard deviation)*
Dichotomous variable (within or after 24 hours)
Endoscopic treatment
Stent grafting (type of graft and size)
Endoscopic clipping (type and number of clips employed)
Endoscopic placement of drainage (type of drainage)
Surgical debridement/drainage procedures through thoracotomy, thoracoscopy, laparotomy or laparoscopy
Cervical debridement and/or drainage
Pleural drainage
Pleural debridement/decortication
Thoracostomy
Laparoscopy
Enteral exclusion/compression
Esophagostomy
Gastrostomy
Surgical local esophageal treatments
Omental, pleural or muscle flap coverage
Repair on T-tube or any other drain with or without tissue reinforcement
Definitive surgical repair
Primary repair with or without tissue reinforcement (omental, pleural or local muscle flap, or fundoplication)
Esophagectomy with or without reconstruction
Esophagogastrectomy with or without reconstruction
Outcome end-points
Need of reoperation/additional procedures on the esophagus
Need of reoperation/additional procedures on extra-esophageal organs and structures
Length of intensive care unit stay (days) (mean ± standard deviation)*
Length of in-hospital stay (days) (mean ± standard deviation)*
Length of follow-up (months) (mean ± standard deviation)*
Main cause of death

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Conclusions

A thorough reporting of patient's comorbidities, characteristics of perforation, treatment strategy, early and late outcome end-points as suggested in this article could be useful for an adequate risk assessment and a critical evaluation of the results of current and future treatment modalities of esophageal perforation.

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