

# Aetiology, treatment and mortality after oesophageal perforation in Denmark

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## ABSTRACT

**INTRODUCTION:** Perforation of the oesophagus into the thoracic cavity is a potentially life-threatening condition. The causes are numerous. Treatment for oesophageal perforation targets mediastinal and pleural contamination. Present knowledge about the causes of perforation and the types of treatment is poor.

**MATERIAL AND METHODS:** A retrospective review was made between 1997 and 2005 based on extracts from the National Patient Registry.

**RESULTS:** A total of 286 patients were diagnosed with perforation of the oesophagus (131 women and 155 men). Their average age was 60 years. A wide spectrum of causes was reported, e.g. instrumentation of the oesophagus 136 (47.6%), spontaneous rupture 89 (31.1%) or procedures otherwise related to surgical intervention  $n = 9$  (3.1%). One third of the patients started conservative treatment 91 (31.9%). The majority of the patients were transferred to a thoracic surgery department for further treatment: about 25% of patients underwent surgery. The average hospitalization time was 18 days. The mortality rate was 21%.

**CONCLUSION:** Oesophageal perforation remains a diagnostic and therapeutic challenge and the condition requires aggressive treatment. Recent consensus in early treatment with thoracotomy, debridement, irrigation and subsequent parenteral nutrition has improved survival. In this material, most perforations were iatrogenic in nature. In the 2002-2005 period, the study showed that 29% of the iatrogenic perforations were caused by the use of a rigid endoscope which is risky and whose use should therefore be restricted. It is advisable to set up national guidelines for treatment of oesophageal perforation and to centralise treatment.

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Perforation of the oesophagus into the thoracic cavity is a rare, potentially life-threatening condition.

The prognosis is determined by several factors, such as delayed treatment, breakthrough to the pleura and contamination with food and bacteria [1, 2].

The causes of perforation of the oesophagus are numerous, ranging from spontaneous rupture to iatrogenic perforation. The number of iatrogenic perforations associated with the development of endoscopic pro-

cedures has been on the rise [3]. Treatment of oesophageal perforation has varied over time. Today, the primary treatment is directed at mediastinal and pleural contamination. There are no specific guidelines for treatment of oesophageal perforation and the principles used include drainage of pollution, surgical closure of the perforation with or without additional oesophageal stenting, fasting and broad-spectrum antibiotics [4, 5].

Current knowledge about the causes of perforation, the type of treatment and where the perforations are treated in Denmark is poor. The present study was therefore initiated by the Danish National Health Board Surgery Group from which earlier investigations have shown that extracts from the National Patient Registry can be used for validation of causes and treatment activities within surgery in Denmark [6, 7]. In connection with the Danish National Health Board specialty plan, the study seeks to describe the causes and treatment of oesophageal perforation in Denmark over a nine-year period. In addition, we evaluated any differences in causes and treatment of oesophageal perforations before and after the speciality plan was introduced in 2001 [8].

## MATERIAL AND METHODS

The study is based on extracts from the National Patient Registry for the period 1 January 1997 to 31 December 2005. Data for patients with the diagnosis code K22.3 (oesophageal perforation) were obtained. Furthermore, data from the National Patient Registry were collected in form of discharge summaries of all admissions, which in many cases also included transfers between departments and readmissions. In some cases, patient records were obtained to achieve complete clarity over the course of events. The causes of oesophageal perforation were recorded as was the hospital department at which the injury or the first hospitalization occurred. All discharge summaries and relevant patient records were reviewed for treatment and referral to thoracic surgery or specialized surgical gastroenterology departments. In-hospital time was recorded from the first admission date, including the transfer to other departments and readmission immediately after primary hospital care. Mortality was recorded as a total of deaths within 30

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**TABLE 1**

Distribution of oesophageal perforations according to departments of injury or first hospitalization department, n (%).

| Department                | 1997-2001 | 2002-2005 |
|---------------------------|-----------|-----------|
| Thoracic surgery          | 13 (8.8)  | 7 (5.1)   |
| Ear, nose throat          | 13 (8.8)  | 23 (16.7) |
| Surgical gastroenterology | 63 (42.6) | 49 (35.5) |
| Internal medicine         | 9 (6.1)   | 6 (4.3)   |
| Other                     | 35 (23.6) | 35 (25.4) |
| Unknown                   | 15 (10.1) | 18 (13.0) |
| Total                     | 148 (100) | 138 (100) |

**TABLE 2**

Distribution of causes of perforation within instrumentation of oesophagus, n (%).

| Cause of perforation | 1997-2001 | 2002-2005 |
|----------------------|-----------|-----------|
| Dilatation           | 41 (56)   | 26 (41)   |
| Endoscopy (flexible) | 19 (26)   | 17 (27)   |
| Endoscopy (rigid)    | 7 (10)    | 18 (29)   |
| Nasogastric tubes    | 6 (8)     | 2 (3)     |
| Total                | 73 (100)  | 63 (100)  |

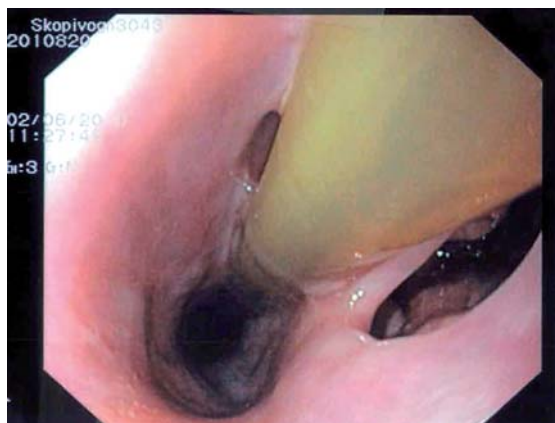
days after the first admission date and deaths during primary hospitalization, including transfer to other departments and readmission.

*Trial registration:* not relevant

## RESULTS

In the period 1997-2005, a total of 286 patients were diagnosed with perforation of the oesophagus.

Their average age was 60 years (range 1-91), 131 were women and 155 were men. In the 1997-2001 period, 148 patients (29.6 patients/year) were recorded and from 2002-2005, 138 patients (34.5 patients/year) were recorded.



Approximately one third of all patients with oesophagus perforation are treated conservatively with nasogastric tubes, fasting and antibiotic treatment.

**Table 1** shows the various departments where the perforation occurred or where the patients were first admitted. The distribution is shown between the two specified time periods. There were no major differences between the time periods, except in ear, nose and throat (ENT) departments. The vast majority of perforations occurred in surgical gastroenterology departments. Patients from *other departments* mainly represent spontaneous perforations admitted through emergency wards. Between the two periods a relative doubling of injuries occurred at ENT departments.

A wide spectrum of causes of oesophageal perforations was reported. Throughout the nine-year period, most perforations occurred during instrumentation of the oesophagus (n = 136 (47.6%)).

Perforation occurred as a spontaneous rupture in connection with vomiting, known as the Boerhaave syndrome in 89 cases (31.1%), and rupture related to surgical intervention (n = 9 (3.1%)). Other causes were corrosion and trauma (n = 49 (17.1%)).

There was no change in the causes of injury during the two periods.

The most common causes of perforation during instrumentation were related to therapeutic dilatation of oesophageal strictures. The most common method deployed was balloon dilatation, whereas others modalities (e.g. Savary and Eder-Poustow) represented only a small part (**Table 2**).

The second most common cause of perforation was endoscopic examination of the oesophagus with or without biopsy. Removal of foreign bodies from the oesophagus with a rigid endoscope has traditionally been used in ENT departments and there was an increase between the two time periods (1997-2001, n = 7; 2002-2005, n = 18). Nasogastric tubes in several forms including Sengstaken-Blakemore tubes to treat oesophageal varices were found to be the cause in only a few cases (Table 2).

In half the cases, the department where the injury occurred offered no treatment (n = 140 (49%)). One third of the patients started conservative treatment in the form of nasogastric tubes, fasting and antibiotic treatment and in some cases drainage of the pleural cavity was applied (n = 91 (31.9%)). A small number of patients underwent surgery at the primary hospital department (n = 22 (7.7%)). A comparison of the two periods showed a decline in surgical intervention at the primary department (**Table 3**).

In both periods, the majority of patients with perforation were transferred to a thoracic surgery department for further treatment: from 1997-2001 a total of 113 of 148 (76%) patients were transferred, from 2002-2005 the number was 102 of 138 (74%) patients.

In the thoracic surgery departments, about 65% of

patients underwent surgery including drainage of the pleura and primary surgical closure of the perforation through a thoracotomy, which in some cases was combined with a pleural or pericardial flap. A small number of patients were treated with T-tubes or surgery combined with stenting of the perforation. A few patients were treated by thoracoscopic surgery (VATS). A total of 29 patients had a resection of their oesophagus performed.

The average hospitalization time (primary hospitalization, transfer and relevant readmission) was 18 days (range 1-97) with no difference between the time periods.

The mortality rate was 21% (30-days) with no difference between the two time periods.

## DISCUSSION

Oesophageal perforation remains a diagnostic and therapeutic challenge. However, there is consensus that early diagnosis and treatment reduces the severity of the disease and reduces mortality [1-5]. The exact cause of the lesion guides the choice of treatment. For example, the pleural and mediastinal contamination seen after spontaneous perforation is not found in perforation after planned endoscopy where patients are fasting and the perforation is detected immediately or shortly after the injury. [9]. Treatment of perforations of the oesophagus has varied between institutions, but the recent consensus in early treatment with thoracotomy, debridement, irrigation and subsequent parenteral nutrition has improved survival of this potentially fatal condition [1-5].

There are currently no national studies on oesophageal perforation and its aetiology, treatment and mortality. Most studies are small series from individual hospitals or regions, which were conducted over long time periods. This complicates comparison of patients due to changes in surgical and anaesthesiological procedures [1-4].

In this material, most perforations were iatrogenic in nature, which corresponds to findings in other studies [1-5, 10, 11]. Results from one of the largest studies accumulated over 21 years with a total of 72 patients showed that perforation by instrumentation accounted for 68% of all perforations, while spontaneous rupture was found in 13% [10] and notably after the development of endoscopic procedures in the upper gastrointestinal tract [11].

Our study shows that the majority of perforations occurred in surgical gastroenterology departments which perform the majority of therapeutic and diagnostic endoscopic procedures in Denmark. In the 2002-2005 period, 29% of the iatrogenic perforations were caused by the use of a rigid endoscope with a doubling in the number



TABLE 3

Distribution of treatment strategies in primary or thoracic surgical departments, n (%).

| Treatment    | 1997-2001 |                   | 2002-2005 |                   |
|--------------|-----------|-------------------|-----------|-------------------|
|              | primary   | thoracic surgical | primary   | thoracic surgical |
| None         | 71 (48)   | 12 (11)           | 69 (50)   | 5 (5)             |
| Conservative | 46 (31)   | 25 (22)           | 45 (33)   | 32 (31)           |
| Operation    | 15 (10)   | 76 (67)           | 7 (5)     | 65 (64)           |
| Unknown      | 16 (11)   | 0                 | 17 (12)   | 0                 |
| Total        | 148 (100) | 113 (100)         | 138 (100) | 102 (100)         |

of perforations caused by rigid endoscope, whereas the share of all other instrumentations declined. It should be noted that procedures with a rigid endoscope require use of general anaesthesia, while flexible endoscopy can be performed without sedation [12].

No difference was found in the number of patients transferred to thoracic surgical departments for treatment between the two periods. Most patients transferred to thoracic surgical departments underwent surgery, which is in accordance with other studies [1, 2, 9, 13]. However, a decrease in the number of patients who underwent surgery was seen between the time periods owing to the growing use of oesophageal stenting; a finding that is also in accordance with previously published results [5, 14].

Most studies have reported a length of stay between 14 and 30 days, which is comparable to that reported in our study (mean 17.6 days), but the length remained unchanged between the study periods. The overall 30-day mortality was 21% where the literature shows a range from 4% to 30% [15-18].

Given the complexity of treatment, the long hospitalization and the high mortality rate, it is advisable to set up national guidelines for the treatment of oesophageal perforation and to centralise treatment. The technically difficult operations are associated with increased mortality if performed at hospitals with a low patient volume [19, 20]. Finally, our study indicates that the use of rigid endoscopy for foreign body removal is risky and is responsible for a large proportion of iatrogenic perforations and that its use should therefore be restricted.

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