

Traumatic rupture of the oesophagus and stomach

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Thirty-nine cases of traumatic perforation of the oesophagus or stomach have been studied. Thirty-two of the perforations followed oesophagoscopy, five were 'spontaneous,' and two were due to damage by a foreign body. Eight of the perforations occurred in the cervical oesophagus, 22 in the thoracic portion, and nine were in either the abdominal oesophagus or the stomach. Treatment was of two types—either operative closure of the perforation or a conservative routine of intravenous fluids, parenteral antibiotics, and cessation of oral feeding. In some patients treated conservatively, drainage procedures were also carried out. Five patients with terminal carcinoma, in whom oesophageal intubation after prolonged dysphagia caused perforation, had no treatment apart from analgesics and sedatives. Several of the patients treated by surgical closure had a concurrent definitive operation (resection of carcinoma in four cases and myotomy for achalasia in two cases). Fourteen of the 21 patients treated by repair or resection of the perforation survived. Ten of the 13 treated conservatively also survived. The good results of conservative treatment for cervical perforations appear to make it the treatment of choice. Only an occasional case of thoracic perforation is suitable for conservative treatment, and as a general rule perforations in this area and in the peritoneal cavity should be treated surgically.

Traumatic perforation of the oesophagus or stomach is usually caused by instrumentation, foreign body trauma, or so-called spontaneous rupture. Of these, perforation during oesophagoscopy is the most common. The rigid metal oesophagoscope and the instruments used for oesophageal dilatation are the principal causes of damage. The relatively recent fibre-optic endoscopes, while bringing with them a much reduced incidence of perforation, do not allow direct visual oesophageal dilatation. There is little doubt that the likelihood of instrumental perforation is greater when the endoscopist lacks experience yet the majority of the perforations in any large series have been done at the hands of experienced endoscopists.

The importance of endoscopic perforations may be gauged from the British Registrar General's Report of 1967 (Table I) which shows this condition to be the commonest cause of death due to

surgical misadventure in Great Britain. A similar position existed in each of the preceding five years.

Foreign-body perforations may occur at the time of swallowing or during removal at oesophagoscopy. They comprise the smallest group of traumatic perforations.

Spontaneous rupture of the oesophagus has come into the surgical limelight only relatively recently. In 1946, Barrett reviewed all the previously reported cases of spontaneous rupture of the oesophagus and found no survivors. He predicted that this unsatisfactory situation would not long continue, and in the very next year he himself was able to produce the first recorded survivor (Barrett, 1947). Since then there have been many reports of patients treated successfully, but it remains an uncommon condition.

CLINICAL MATERIAL

In the period 1948–67, 39 cases of traumatic perforation of the oesophagus have been recorded in the Thoracic Unit of the Royal Infirmary, Edinburgh (Table II). Of these, 32 were instrumental, two followed foreign body trauma, and five were spontaneous.

INSTRUMENTAL PERFORATION (32 cases) All 32 cases of instrumental perforation occurred at

TABLE I

BRITISH REGISTRAR GENERAL'S REPORT 1967: DEATHS DUE TO THERAPEUTIC MISADVENTURE

Deaths due to oesophagoscopy and dilatation	..	..	12
Medical deaths (steroids, anticoagulants, etc.)	..	..	103
Surgical deaths .. .. .	..	..	74
Total number of deaths .. .. .	..	..	177

TABLE II

Type of Perforation	No.	Position of Perforation		
		Neck	Thorax	Abdomen
Instrumental ..	32	7	16	9
Foreign-body ..	2	1	1	—
Spontaneous ..	5	—	5	—
Totals	39	8	22	9

oesophagoscopy. One case was referred from another centre for treatment of the perforation. In the same period, 1948–67, approximately 4,800 oesophagoscopies were carried out by members of the Thoracic Unit. Nineteen of the 31 perforations done at the unit were associated with therapeutic dilatation, and the remaining 12 occurred in patients having only a diagnostic oesophagoscopy.

FOREIGN-BODY PERFORATION (2 cases) In one of these cases the passage of a rigid nasogastric tube was attempted in an unconscious patient. The tube perforated the wall of the oesophagus at the level of the cricopharyngeus. The second case was of perforation by a chop bone; this patient was referred to the unit many days after the initial episode.

SPONTANEOUS PERFORATION (5 cases) Three of these cases presented the typical picture of a complete lower oesophageal rupture after vomiting. In the remaining two the clinical features were similar but at oesophagoscopy only partial-thickness tears of the oesophageal wall were found.

SITES OF PERFORATION These are shown in Table II.

Instrumental perforation (32 cases) Seven of the 32 perforations occurred in the region of the cricopharyngeus, 16 occurred in the thorax, and nine in the abdomen.

Foreign-body perforation (2 cases) One of these occurred in the neck and the other in the thorax.

Spontaneous perforation (5 cases) All occurred in the classical position in the lowest third of the oesophagus.

FACTORS PERTINENT TO ENDOSCOPIC PERFORATION The following factors are pertinent: disease process necessitating oesophagoscopy; oesophageal

dilatation; insertion of an oesophageal tube; recognition of damage at the time of the endoscopy; and the relation of the level of the perforation to the lesion.

Disease process necessitating oesophagoscopy: Details of the instrumental perforations are given in Table III.

TABLE III

Type of Condition associated with Instrumental Perforation	No.	Position of Perforation		
		Neck	Thorax	Abdomen
Neoplasm	15	1	7	7
Hiatus hernia with peptic stricture	9	3	5	1
Hiatus hernia without peptic stricture ..	5	2	3	—
Achalasia	3	1	1	1
Totals	32	7	16	9

(a) *Oesophageal neoplasm* (15 cases) This was the commonest disease in which instrumental perforation occurred. In all except one case the tumour was either a squamous carcinoma of the oesophagus or an adenocarcinoma of the proximal stomach involving the oesophagus. The exception was a plexiform neurofibroma of the proximal stomach. Only one of the 15 perforations in cases of neoplasm occurred in the cervical region. Seven were situated in the thorax and seven in the abdomen.

(b) *Hiatus hernia with peptic stricture* (9 cases) Most peptic strictures associated with hiatus hernia that have presented to the unit have been treated by dilatation of the stricture and repair of the hernia. The strictures have all been dilated under direct vision, using the Negus oesophagoscope, gum elastic dilators, and sometimes the Negus hydrostatic dilator. Three of these perforations occurred in the neck, five were situated in the thorax, and one in the abdomen.

(c) *Hiatus hernia without peptic stricture* (5 cases) Although hiatus hernia without peptic stricture is more common, the absence of the need for repeated dilatations resulted in a reduced incidence of perforation in these cases. There were no abdominal perforations in this group. Two were situated in the neck and three in the thorax.

(d) *Achalasia* (3 cases) One perforation in this group was situated in the neck, one was in the lower thoracic oesophagus, and the third was in the abdominal oesophagus. The two lower per-

forations occurred during dilatation with the hydrostatic bag. The incidence of this complication at the Mayo Clinic was assessed at 2% (Flavell, 1963) and our experience parallels this.

Performance of oesophageal dilatation Of the 32 instrumental perforations, 19 were associated with oesophageal dilatation. In none of these was the perforation at the cricopharyngeus. In 11 the perforation was situated in the thorax, and in the remaining eight in the abdomen (Table IV). In only six cases was the dilatation recorded as difficult. In five it was recorded as easy and in eight no comment was made (Table V).

TABLE IV

LEVEL OF PERFORATION IN PATIENTS UNDERGOING DILATATION

No.	Level of Perforation		
	Neck	Thorax	Abdomen
19	0	11	8

TABLE V

DEGREE OF DIFFICULTY ASSOCIATED WITH DILATATION

No.	Degree of Difficulty		
	Easy	Difficult	No Comment
19	5	6	8

Insertion of oesophageal tube An oesophageal tube was inserted in 12 of the 32 instrumental perforations. In 11 cases the diagnosis of gastro-oesophageal cancer was proved by biopsy but in the twelfth the stricture was found at biopsy to be a simple peptic stricture. None of these 12 patients had a perforation in the neck.

Recognition of damage at time of endoscopy In only four of the 32 cases of instrumental perforation was the damage recognized at the time of the endoscopy. In two, lacerations were seen at the cricopharyngeus. In a third, a tear of the lower oesophagus was found after a bout of coughing, and in the fourth, distension of the abdomen was noted while a scalene node biopsy was being carried out immediately after the biopsy.

Relation of level of perforation to lesion Seven of the 32 perforations occurred at the cricopharyngeus and were so far above the lesion as to have no dependence on the nature or site of the primary oesophageal lesion. Of the remaining 24 in the thorax or abdomen, only six were recorded

TABLE VI

PERFORATION RELATIVE TO THE LESION

Total ¹	At Lesion	Proximal	Distal	Unknown
24	6	5	9	4

¹ Eight perforations in the neck are excluded.

as being exactly at the site of the stricture. Five were proximal and nine were distal to the lesion (Table VI). In four cases the site of perforation relative to the lesion remains unknown. They were cases of terminal carcinoma, and perforation occurred at intubation.

CLINICAL FEATURES OF OESOPHAGEAL PERFORATION Pain was the commonest symptom, and all patients in this series complained of this in some degree. It was felt in the neck, the back or the abdomen, depending on the site of perforation. Surgical emphysema occurred in all patients with cervical perforations but it was found in only two of the 24 thoracic and abdominal cases.

In four cases profound shock was the outstanding feature, and in all these the thoracic oesophagus was ruptured. Chronic pyrexia was the prominent feature of two cases, one of which presented some days after the perforation. In two old patients with advanced carcinoma, in whom perforation followed intubation, the diagnosis was established definitely only at necropsy.

The dramatic clinical picture associated with spontaneous rupture of the oesophagus has been well described by Barrett (1946). All of the five cases in this series followed the classical description. Complete rupture of the oesophageal wall was followed by more severe shock than was partial rupture.

RADIOLOGICAL APPEARANCES ASSOCIATED WITH PERFORATION All patients, with the exception of the two with incomplete perforations (and four with terminal carcinoma who were not examined radiologically), developed radiographic changes. These were not always present at an early stage. Surgical emphysema was visible in the neck in all the cases of cervical and in two of thoracic perforation. Gas was present under the diaphragm in six of the nine cases of abdominal perforation.

The initial chest radiographs of six of the 22 patients with thoracic perforations showed a pneumothorax and a further six showed a hydro-pneumothorax. Pneumomediastinum was seen in another six patients. Radio-opaque swallows were not routinely carried out and when they were

done they were not always helpful. Two patients who had normal gastrographin swallows were shown at operation soon after to have thoracic perforations.

EFFECT OF DELAYED DIAGNOSIS Twenty-seven of the 37 patients with complete oesophageal rupture were diagnosed within 24 hours of perforation. Nineteen of the 27 patients survived. Of the 10 in whom the diagnosis was made after 24 hours, only two survived (Table VII). However, none of

TABLE VII

EFFECT OF DELAYED DIAGNOSIS

Time to Diagnosis	No.	Survived	Died
Less than 24 hours	27	19	8
More than 24 hours	10	2	8

these 10 cases in whom diagnosis was delayed had a cervical perforation with its attendant good prognosis, and two suffered from terminal carcinoma and were treated only with sedatives. Even allowing for these factors, the desirability of early diagnosis is well demonstrated.

TREATMENT Treatment has fallen into three categories.

Operative closure This is defined as direct closure of the perforation. Drainage procedures are not included. The perforation was in all cases closed with interrupted silk sutures in one or two layers. Closure was in some instances combined with a definitive operation for the initial disease process. In four patients with carcinoma, closure of the perforation was combined with resection of the tumour (Table VIII). Two of these survived. Two patients with achalasia underwent Heller's operation following closure of the perforation. None of the patients with a hiatus hernia underwent repair of the hernia following closure of the perforation.

None of the patients with cervical perforations was treated surgically. Nine of the 13 with thoracic perforations who were treated surgically survived,

TABLE VIII

TYPE OF SURGICAL PROCEDURE

Procedure	No.	Survived	Died
Closure	17	12 (2 Heller's operation)	5
Resection	4	2	2
Totals	21	14	7

TABLE IX

SURGICAL TREATMENT AND SITE

Site	No.	Survived	Died
Neck	—	—	—
Thorax	13	9	4 (2 carcinomas)
Abdomen	8	5	3 (3 carcinomas)
Totals	21	14	7

and five of the eight with abdominal perforations treated surgically also survived (Table IX). Five of the seven deaths associated with operative closure were of patients with carcinoma.

Early surgical treatment was an important factor in its success. Twelve of the 15 patients treated surgically within 24 hours of perforation survived, whereas only two of the six treated surgically after 24 hours survived (Table X).

TABLE X

DELAY TO SURGICAL TREATMENT

Time	No.	Survived	Died
Less than 24 hours	15	12	3
More than 24 hours	6	2	4
Totals	21	14	7

Conservative treatment This is defined so as to include those patients who had surgical drainage procedures but in whom no attempt was made to close the perforation. The usual conservative routine was to withhold food and to give intravenous fluids and parenteral antibiotics. In some cases antibiotics in solution were also given by mouth. All patients with cervical perforations were treated in this fashion and all except one survived. The exception was a chronic alcoholic who was admitted with a nembutal overdose. A nasogastric tube was forced through the oesophageal wall at the level of the cricopharyngeus.

No patient with an abdominal perforation was treated conservatively (Table XI). Five with thoracic perforations were treated conservatively.

TABLE XI

CONSERVATIVE TREATMENT

Site	No.	Survived	Died
Neck	8	7	1
Thorax	5	3	2 (1 foreign body)
Abdomen	—	—	—
Totals	13	10	3

These either had a small perforation and were not shocked and had no radiological evidence of a pleural collection, or presented many days after the initial episode of perforation and were thus considered unsuitable for surgical closure. Two of these five patients with thoracic perforations treated conservatively died. They both fell into the latter category.

Sedation and analgesics only (5 cases) This treatment was used in patients with terminal carcinoma in whom death came as a welcome relief after prolonged dysphagia. They were patients in whom oesophageal tubes had been passed as a last resort. In two the diagnosis was made only at necropsy when the end of the tube was seen to be lodged in tumour masses outside the oesophageal lumen.

OVERALL MORTALITY RESULTING FROM PERFORATION This may be related to the basic disease process associated with the perforation, the site of the perforation, and the type of treatment employed.

Associated disease process The prognosis in malignant disease with oesophageal perforation is bad (Table XII). Nine of the 15 patients in this

TABLE XII

MORTALITY IN RELATION TO BASIC DISEASE PROCESS

Type	No.	Died	Per cent
Benign ..	24	6	25
Malignant ..	15	9	60 exclude terminal carcinoma = 40%
Totals ..	39	15	38 exclude terminal carcinoma = 29%

group died. Included, however, are the five with terminal carcinoma for whom no specific treatment after perforation was attempted. If these are excluded the mortality drops to 40% (4 out of 10). Perforations occurring in patients with non-malignant disease resulted in a lower mortality of 25% (6 out of 24). The overall mortality rate was thus 38% (15 out of 39), but if the patients with terminal carcinoma are excluded this falls to 29%.

Site of perforation The mortality rate of cervical perforation was comparatively low (Table XIII). The patient who died was a chronic alcoholic who had taken an overdose of barbiturates and suffered a cervical laceration when a rigid nasogastric tube was passed. It is possible that death was the consequence of poisoning rather than oesophageal perforation. Thoracic and abdominal perforations

TABLE XIII

MORTALITY IN RELATION TO SITE OF PERFORATION

Site	No.	Died	Per cent
Neck ..	8	1	13
Thorax ..	22	10	45 exclude terminal carcinoma = 33%
Abdomen ..	9	4	44 exclude terminal carcinoma = 38%
Totals ..	39	15	38 exclude terminal carcinoma = 29%

had comparatively high mortality rates and these obviously are extremely serious conditions. If terminal cancer perforations are excluded the mortality rates show a moderate fall.

Type of treatment The best results occurred with conservative treatment (Table XIV). However, this was influenced by the group of cervical perforations with their attendant good prognosis. Operative treatment, on the other hand, was employed in all patients with carcinoma except one who had a cervical perforation and five with terminal carcinoma, and because of this the outlook was less good. As expected, the absence of specific treatment in patients with terminal carcinoma led to 100% mortality.

TABLE XIV

MORTALITY IN RELATION TO TREATMENT

Method	No.	Died	Per cent
Surgical ..	21	7	33
Conservative ..	13	3	23
Sedation ..	5	5	100
Total ..	39	15	38 exclude terminal carcinoma = 29%

DISCUSSION

The seriousness of oesophageal perforation is evident when one considers that 15 out of 39 patients died following perforation. The mortality rate of perforation in relation to non-malignant disease is approximately half that of perforation in relation to carcinoma. Froggatt and Gunning (1966) made a similar observation in their review of 33 perforations.

Although some writers (Nealon, Templeton, Cuddy, and Gibbon, 1961) recommend surgical closure of all perforations, the good results in this series from conservative treatment appear to make it the treatment of choice for cervical perforations. With thoracic perforations there is little doubt that operative closure is indicated except in the case of long delayed diagnosis or a very small leak as

evidenced by the absence of a pleural collection. All abdominal perforations also should be treated by surgical closure. It seems reasonable in patients in relatively good condition to proceed to a definitive operation if one is indicated, such as a resection of a carcinoma, Heller's operation or even repair of a hiatus hernia. However, if there is a gross pleural or abdominal soiling and the suture of the oesophageal laceration has not involved disturbance of the hiatus oesophagus, it may be better to postpone repair of the hernia until a later date.

If a perforation is proximal to a very tight stricture which has not been relieved at oesophagoscopy then some surgical procedure should be employed to relieve the obstruction as simple closure of the perforation is unlikely to be successful. The procedure of choice is usually resection. If a perforation is distal to a stricture simple closure is likely to be effective. In this series there was no instance of a peptic stricture which required resection in order to relieve obstruction.

It is often difficult to be certain of the exact site of leakage. Only 13% of the endoscopic perforations were recognized at the time of endoscopy, which parallels the experience of Bill and his colleagues (Bill, Mebust, and Sauvage, 1963). Radio-opaque swallows are not always helpful and may be misleading. This fact has also been observed by Hugh (1965) and Kerr (1962). The latter suggested passing a Ryle tube and running a small amount of radio-opaque material through it during withdrawal. However, the passage of a tube in a patient with a friable oesophagus as a result of perforation would seem a somewhat risky procedure. The patient is often so ill that a good radio-opaque swallow cannot be obtained. Two patients in this series in whom no perforation could be demonstrated radiographically did prove at subsequent thoracotomy to have a full-thickness laceration.

The commonest site of endoscopic perforation was distal to the lesion, presumably because the bougie, after passing through the stricture, became caught in a mucosal fold. When the bougie is grasped by the stricture the endoscopist loses all feeling at its tip and fails to appreciate the rela-

tively slight additional resistance offered by the wall of the viscus.

When the decision is made to undertake operative closure of a thoracic perforation the best exposure of the perforation is obtained by performing a thoracotomy on the same side as the resultant pneumothorax or pleural collection. For abdominal perforation a left thoracotomy through the bed of the eighth rib offers the best exposure.

'Spontaneous' rupture of the oesophagus may be truly spontaneous. Clark and Tankel (1964) recorded the case of a patient who was sleeping at the time of onset. It may follow a blow on the stomach (Nelson, 1959). However, it is usually associated with vigorous vomiting. It may also be associated with the Mallory-Weiss syndrome (Mallory and Weiss, 1929) of lower oesophageal bleeding. Atkinson, Bottrill, Edwards, Mitchell, Peet, and Williams (1961) reported that two of their 11 cases of this syndrome presented with mediastinitis due to oesophageal rupture. There is no doubt that early recognition and prompt surgical treatment have changed the outlook in this condition.

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