

# Recognition and Treatment of Esophageal Perforations\*

DONALD L. PAULSON, M.D., ROBERT R. SHAW, M.D., JOHN L. KEE, M.D.

Dallas, Texas

PERFORATIONS of the esophagus may be due to trauma, either direct or indirect, inflammatory and neoplastic lesions (Table 1). While perforations of the stomach and duodenum are almost always due to intrinsic disease of these organs, the most frequent cause of perforations of the esophagus is trauma. Of all the traumatic agents responsible, endoscopic instruments such as the esophagoscope and the dilating sound are the most frequent offenders.

The increasing use of endoscopic procedures in the diagnosis and treatment of diseases of the esophagus, demanded by advances in surgery, accounts for a pronounced increase in incidence of esophageal perforations in recent years. Jermin<sup>2</sup> reported 22 patients with esophageal perforations in the 11-year-period prior to 1936, at the Mount Sinai Hospital, New York, while in the 12-year-period of 1936 through 1947, there were 47 patients. Seybold, Johnson and Leary<sup>5</sup> found 21 cases of esophageal perforation at the Mayo Clinic in the 36-year period from 1907 through 1942, while in a six-and-one-half-year-period from 1943 to 1949, there were 29 cases. The endoscopic procedures which appear to be the most hazardous are those for removal of foreign bodies and dilatation of strictures. In the authors' series of 23 esophageal perforations in a 12-year-period from 1946 to 1958 (Table 2), three followed diagnostic esophagoscopy, four followed esophagoscopy for removal of a foreign body, four were due to perforations produced by the foreign body itself, six followed dilatation, four were spontaneous, and two were due to closed

trauma associated with rupture of the trachea.

Indirect trauma, such as the type associated with the production of a sudden high intra-esophageal pressure transmitted from a full stomach in the act of severe vomiting and resulting in so-called spontaneous or postemetic rupture of the left lateral wall of the lower esophagus, is being recognized in increasing numbers as an important cause of esophageal perforation as the diagnosis of this condition becomes better appreciated. Closed rupture of the esophagus may occur as a result of nonpenetrating trauma to the chest wall or neck and may occur in association with closed rupture of the trachea or bronchi. Those perforations associated with strictures may occur as a result of high pressure below the stricture induced by vomiting.

Inflammatory lesions such as esophagitis, peptic ulceration or tuberculosis may also be responsible for esophageal perforations as well as diverticulitis, abscess or aneurysm and certain neurogenic ulcerations associated with lesions of the mid-brain. Those perforations due to esophagitis or peptic ulceration are found frequently in association with diaphragmatic hernia.

Tumors of the esophagus—benign or malignant—at times produce perforations or result in perforation following instrumentation.

## Diagnosis

Recognition of an esophageal perforation is not difficult usually, provided the clinician is alert to its possibility. The diagnosis of a perforation following instrumentation or the ingestion of a foreign body usually is relatively easy, but the condition readily may

\* Submitted for publication August 7, 1959.

TABLE 1. *Classification of Perforations of the Esophagus*

I. Traumatic
A. Direct
1. Instrumental
a) Esophagoscopy and gastroscopic examinations
b) Dilatation, bouginage or intubation
c) Surgical
2. Foreign Bodies
a) Ingested
b) Missile or stab wounds
3. Caustics
B. Indirect
1. Spontaneous rupture (postemetic rupture)
2. Closed rupture
3. Associated with stricture
II. Inflammatory
A. Esophagitis
B. Peptic ulceration
C. Tuberculosis (adjacent lymph nodes)
D. Diverticulitis
E. Abscess or aneurysm
F. Neurogenic ulceration
III. Neoplastic
A. Benign
B. Malignant

go unrecognized or misdiagnosed following indirect trauma such as closed or postemetic rupture. The inflammatory or neoplastic lesions which predispose to perforations of the esophagus frequently implicate that

organ and lead to recognition. Advances in the early institution of appropriate therapy for esophageal perforations with a marked reduction in morbidity and mortality depend on prompt recognition.

The history of instrumentation or the ingestion of a foreign body in a patient who develops signs of air in the neck or early mediastinitis immediately suggests perforation despite the protestations of the endoscopist who frequently is unaware of producing a perforation. Pain in the cervical, thoracic or the epigastric regions which is severe and occurs with the ingestion of a foreign body, after instrumentation or follows vigorous vomiting should alert the clinician to a perforation. Fever appears early as does a markedly elevated pulse rate and dysphagia to be followed by respiratory distress, cyanosis and shock. Perforations in the lower fourth of the esophagus, because of the location of the pain and intense spasm of the muscles of the abdominal wall, may be misdiagnosed as a perforated peptic ulcer and an abdominal exploration may be advised erroneously. Likewise, the erroneous diagnoses of coronary occlusion or dissecting aneurysm are not uncommon following a postemetic perforation of the lower esophagus associated with severe pain in the lower chest, epigastrium or back and shock.

TABLE 2. *Results of Treatment of Esophageal Perforations, 1946-1958*

Course	Number	Treatment			Deaths
		Drugs	Drainage	Closure	
Diagnostic esophagoscopy	3		2	1	0
Esophagoscopy for foreign body	4	*	1	2	0
Foreign body alone	4	**	2	0	0
Dilatation	6	5		1	4
Spontaneous	4		1	3	0
Closed trauma	2		1	1	0
Totals	23	5	7	8	4 (18%)

The average morbidity for drainage procedures was 9 months (2 weeks to 2 years); for closure 2 months (1 to 4 months).

\* One foreign body removed from thyroid gland.

\*\* One foreign body resulted in an esophagobronchial fistula. One foreign body perforated directly into the larynx.

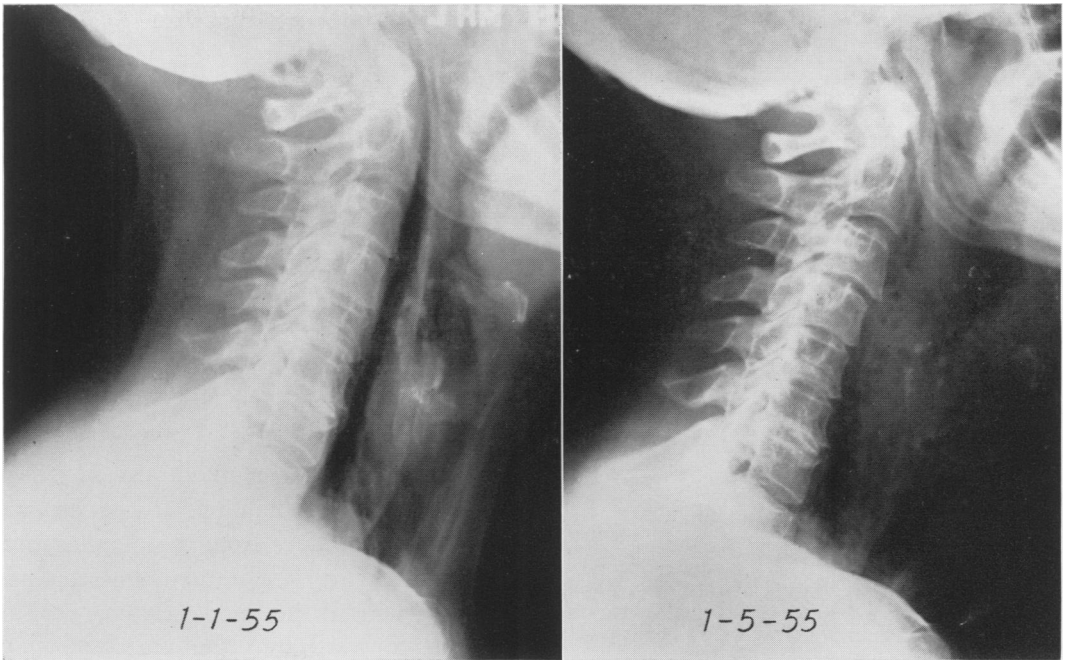


FIG. 1. Air in tissues of the neck, widening of the retrovisceral space and anterior displacement of the trachea demonstrated by roentgenograms of the neck of a woman who sustained a perforation of the cervical esophagus due to the ingestion of a chicken bone. Note progression in four days.

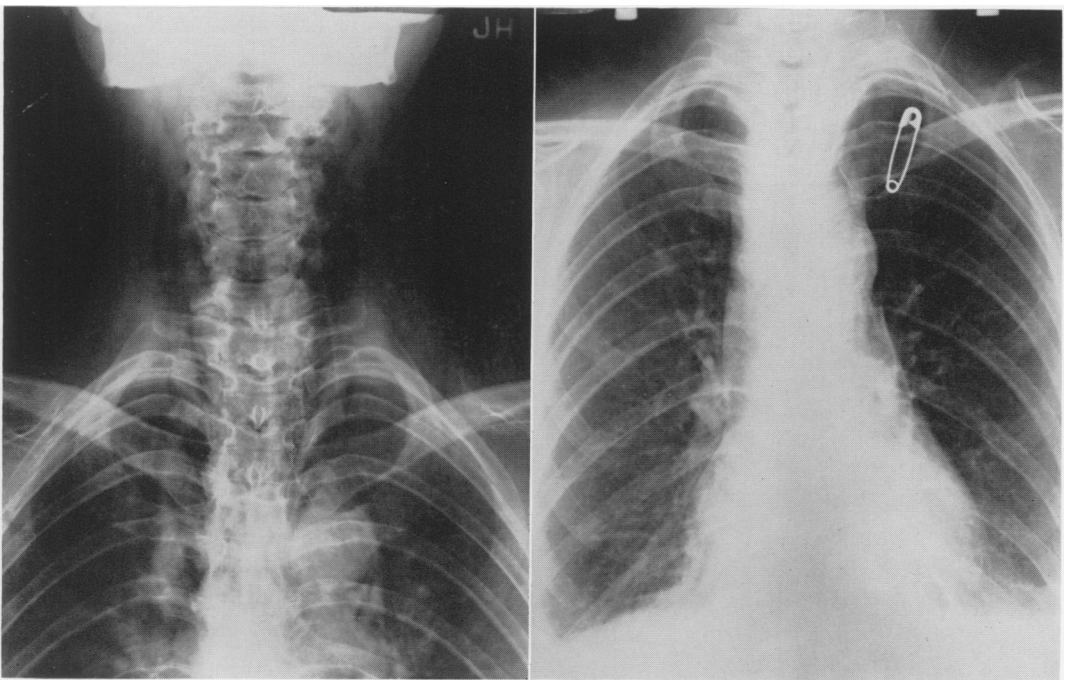


FIG. 2. Same patient as in Figure 1 demonstrating air in the neck and superior mediastinum and fluid in the pleural space.

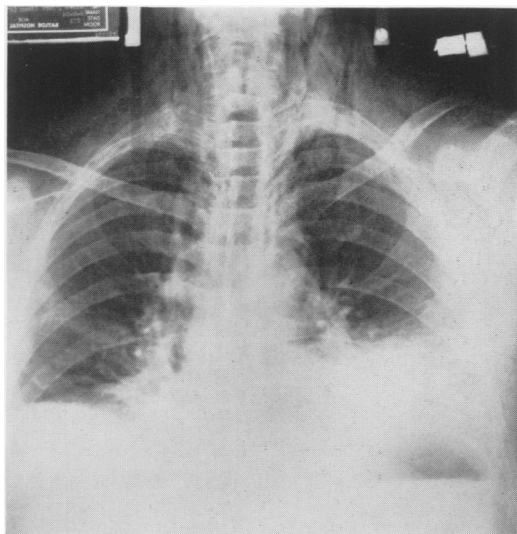


FIG. 3. Roentgenogram of the chest eight hours after a postemetic perforation of the lower esophagus demonstrating fluid in the pleural space and air in the mediastinum which has dissected upward into the neck.

The voice has a peculiar nasal twang (Samson<sup>4</sup>) due to emphysema in the tissues, and movements involving the spine are painful and resisted by the patient.

Roentgenographic studies are imperative for an accurate diagnosis of esophageal perforation. Plain films of the neck or thorax are usually sufficient. However, ex-

amination of the esophagus with radio-opaque liquids is often of assistance in localizing the perforation.

The most important roentgen signs in the cervical region are evidence of gas in the tissues, widening of the retrovisceral space, broadening of the superior mediastinum and anterior or lateral displacement of the trachea (Fig. 1). Pleural fluid may develop secondarily (Fig. 2).

In the thoracic perforations, widening of the mediastinum, air in the mediastinum or neck, fluid levels in the mediastinum, pleural fluid or pneumothorax are seen singly or in combination. If the air and fluid which escapes from the esophagus as a result of a perforation are confined largely within the mediastinum, the air escapes upward into the neck and fluid levels may be present. Mediastinal and cervical emphysema almost always indicate a perforation of the esophagus or the respiratory tract (Fig. 3). Rupture of the air and fluid through the mediastinal pleura results in pleural fluid and a pneumothorax (Fig. 4). These findings serve to differentiate an esophageal perforation from a perforation of an abdominal organ.

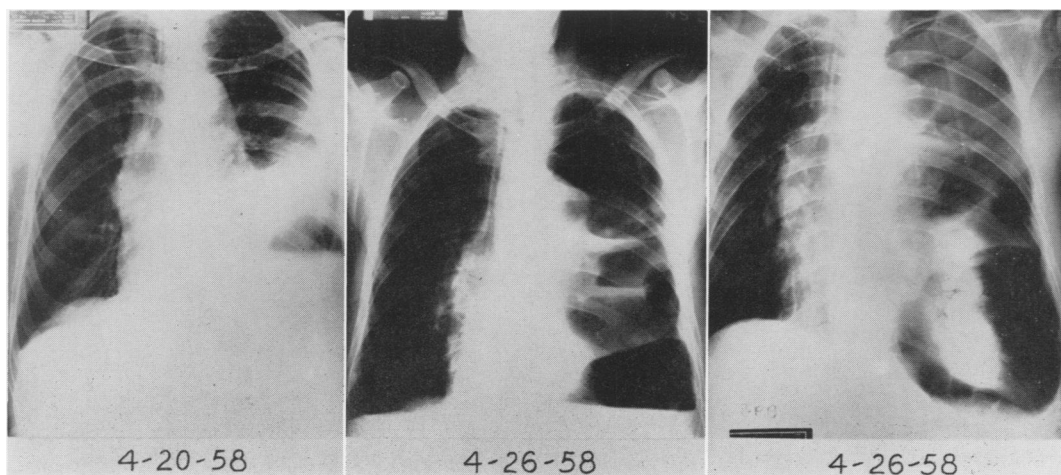


FIG. 4. Roentgenograms of the chest of a 76-year-old man whose spontaneous perforation of the esophagus went unrecognized for six days. Air in the mediastinum, fluid and air in the pleural space with multiple fluid levels are demonstrated. The esophageal perforation was demonstrated by use of Lipiodol.

The use of liquid contrast media is not necessary in cases where the roentgen findings by inference localize the perforation, but may be of great assistance in proving a perforation in doubtful cases particularly early. Liquid contrast media are to be preferred because of the undesirability of barium in the loose mediastinal tissues and the failure of thick barium to demonstrate small perforations.

Occasionally a perforating foreign body enters the trachea or bronchi directly from the esophagus without traversing or infecting the surrounding tissues. This occurred in two of our cases. In one patient a swallowed chicken bone was removed from a perforation between the anterior wall of the esophagus and the larynx. Another patient was found to have an esophagobronchial fistula one week after a piece of pork chop became impacted in his esophagus. The fistula healed within one month, the patient being fed by means of a Levine tube. In one additional case a fish bone was removed from the lateral lobe of the thyroid gland five weeks after the patient knowingly had it lodge in her "throat" and had undergone two futile esophagosopic examinations for its removal (Fig. 5). Barrett<sup>1</sup> has reported the unusual case of a two-year-old girl who choked on a wire hair grip in her mouth. The foreign body was later found and removed from the right ventricle of the heart; the explanation being that it had perforated the wall of the piriform fossa into the lumen of the adjacent jugular vein, fallen through the right atrium into the inferior vena cava and, during a laparotomy to find the foreign body, it had been carried into the right side of the heart as a venous embolus.

Perforations due to missiles, stab wounds or surgical injuries frequently go unrecognized until signs of infection of the surrounding tissues supervene.

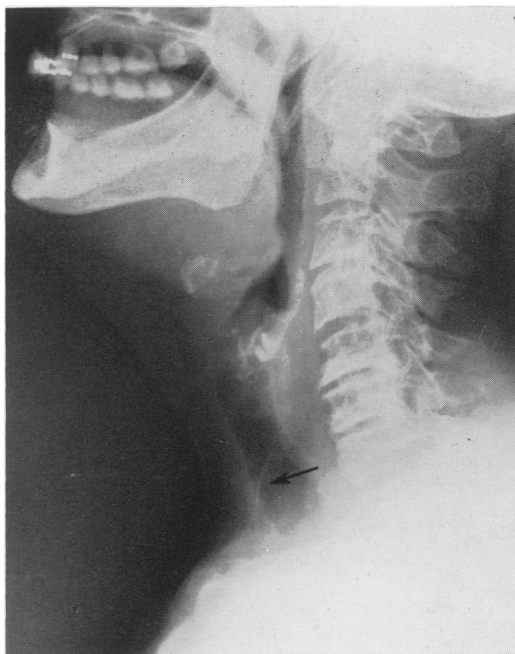


FIG. 5. Fish bone found in the lateral lobe of the thyroid gland five weeks after ingestion.

### Treatment

Recent experience has demonstrated that prompt surgical closure with liberal use of antimicrobial agents can markedly reduce the morbidity and mortality of perforations of the esophagus and is superior to the more conservative measures of drainage or drug therapy alone. Perforation of the alimentary canal at any level is a serious occurrence because of infection of body tissues or cavities. Perforations of the esophagus, just as in the case of stomach or intestines, demand early evacuation of infection and prompt closure of the opening. Antimicrobial therapy makes this possible even following late recognition, and reduces morbidity and mortality.

The mortality of untreated perforations of the esophagus is high, in the range of 70 per cent in Jermin's series.<sup>2</sup> Seybold *et al.*<sup>5</sup> report a mortality in the same range with no antibacterial drugs and of close to 30 per cent for all cases when one or more antimicrobial agents were used. The mor-

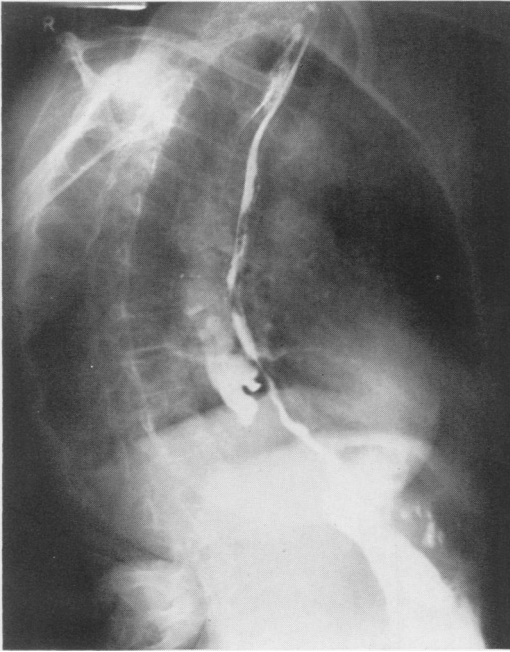


FIG. 6. Roentgenogram demonstrating a posterior perforation of the cervical esophagus in a 73-year-old woman with moderate kyphosis and spurring of the vertebrae and following a diagnostic esophagosopic examination.

tality of 25 patients treated surgically, largely by drainage in the antimicrobial drug era (1943–1949) was close to 20 per cent while the mortality of patients not treated by surgery in the same period was 70 per cent. Jermin<sup>2</sup> reports an operative mortality of 14 per cent and a nonoperative mortality of 40 per cent in the period 1936–1947. Figures of mortality do not express the morbidity of the surviving patients. Barrett<sup>1</sup> has well stated that “to treat a perforation conservatively may succeed; but it is likely to fail in that the patient, who survives the emergency, can develop a mediastinal abscess or pleural complications and these result in prolonged illness and pathological sequelae which can be virtually untreatable.”

Recent reports, particularly those of Weisel and Raine,<sup>6</sup> Overstreet and Och-sner,<sup>3</sup> and others, notably in the case of spontaneous rupture, have demonstrated that closure of the perforation with drain-

age of the fascial, mediastinal or pleural space, antimicrobial drugs and general supportive therapy results in a low mortality, healing of the perforation and a low morbidity.

The authors' experience with 23 patients having esophageal perforations is tabulated in Table 2. Four patients died resulting in a mortality of 18 per cent of the entire group. All of the deaths occurred following perforation due to dilatation; three in infants after injudicious attempts to dilate strictures at the site of anastomoses for atresia of the esophagus and one after dilatation of a stenosis due to esophageal carcinoma. Surgical drainage or closure was not attempted in these cases for obvious reasons, all being treated by antimicrobial therapy solely. One additional patient was treated successfully by means of drug therapy alone. Seven patients were treated by means of drainage

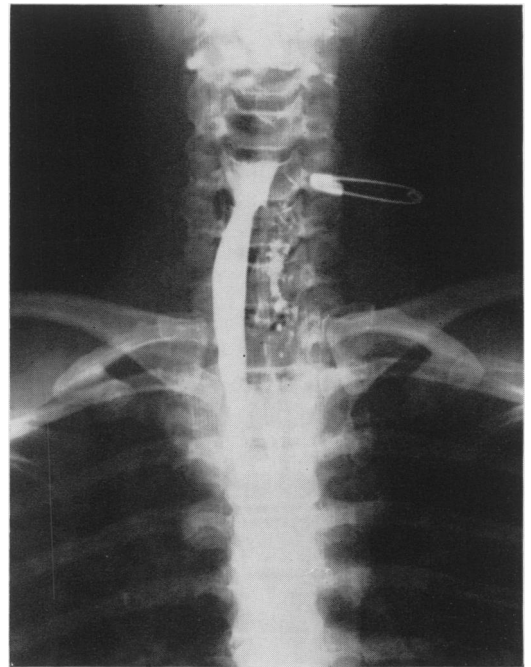


FIG. 7. Chronic cervical and superior mediastinal abscess with a persistent esophageal fistula developing two months previously following the ingestion of a chicken bone and attempted esophagosopic removal. More than a year was required for healing with drainage.

and antimicrobial therapy with no mortalities but with a morbidity of from two weeks to two years, the average being nine months. Three of these patients required one to two years for recovery. Eight patients were treated by means of a combination of closure of the perforation, drainage and antimicrobial therapy with no mortalities and an average morbidity of two months, the longest period for recovery being four months. One foreign body was recovered from the thyroid gland and another from the esophagus after perforation of the anterior esophageal wall into the larynx. One foreign body produced an esophagobronchial fistula which healed within a month with expectant treatment.

The mortality of perforations of the cervical esophagus is low when treated by drainage, but the morbidity is high. Nine perforations involved the cervical region,

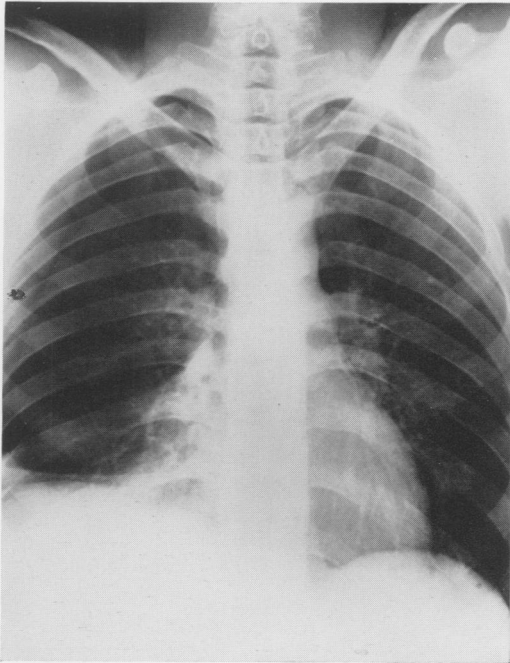


FIG. 8. Pneumothorax on the right suggesting a perforation of esophagus six hours after attempted dilatation of a cardiospasm. Thoracotomy, suture of the perforation, drainage of the pleural space and antimicrobial therapy resulted in immediate complete recovery. (Case included by the courtesy of Dr. Eldon K. Seibel.)

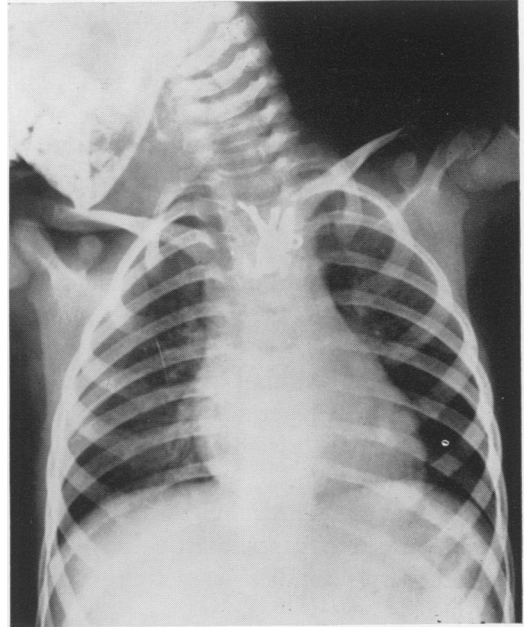


FIG. 9. Roentgenogram of the chest of a two-year-old child with a metal Pegasus impacted in the upper thoracic esophagus. Attempted esophagoscopy removal resulted in perforation of the esophagus. Immediate thoracotomy, removal of the foreign body and repair of the esophagus resulted in prompt recovery.

six of which were treated by drainage. There were no mortalities, but one to two years were required in three patients for recovery.

The mortality of the 14 thoracic perforations in the authors' series was high; four patients on drug therapy alone, succumbed. Seven of the thoracic perforations were treated by closure and one by drainage with no mortalities and a low morbidity.

### Cervical Perforations

Perforations of the cervical esophagus are seldom recognized when they occur and may be late in developing. They usually are located in the midline posteriorly and are nearly always below the cricopharyngeal sphincter (Fig. 6). The explanation commonly given is that the lesion is a linear necrosis of the esophageal wall produced by the pressure of the rigid barrel of the esophagoscope against the

anterior aspect of lipped, spurred, prominent or fixed cervical vertebrae exaggerated by the hyperextended head. This accounts for the lack of recognition on the part of the endoscopist and the delay in appearance of symptoms indicative of infection.

Although some patients may recover with the use of antimicrobial agents alone, prompt exposure, closure of the perforation and drainage of the periesophageal space will result in the saving of more lives and prevent long periods of chronic illness due to fistulae, stricture, and persistent abscesses (Fig. 7).

Early adequate drainage may be sufficient in some cases, particularly if the perforation is small, but nothing will be

lost and much may be gained by an attempt at repair of the rent in the esophageal wall at the same time in spite of secondary infection.

Drainage is all that can be done if the patient is seen late with frank abscess formation and frequently must be extended to the mediastinal as well as the cervical regions through a cervical approach.

### Thoracic Perforations

Perforations of the thoracic esophagus require prompt closure, drainage of the pleural space and antimicrobial therapy (Fig. 8). As soon as the diagnosis is made, regardless of the apparent poor condition of the patient, the infection must be evacuated, the esophagus surgically repaired,

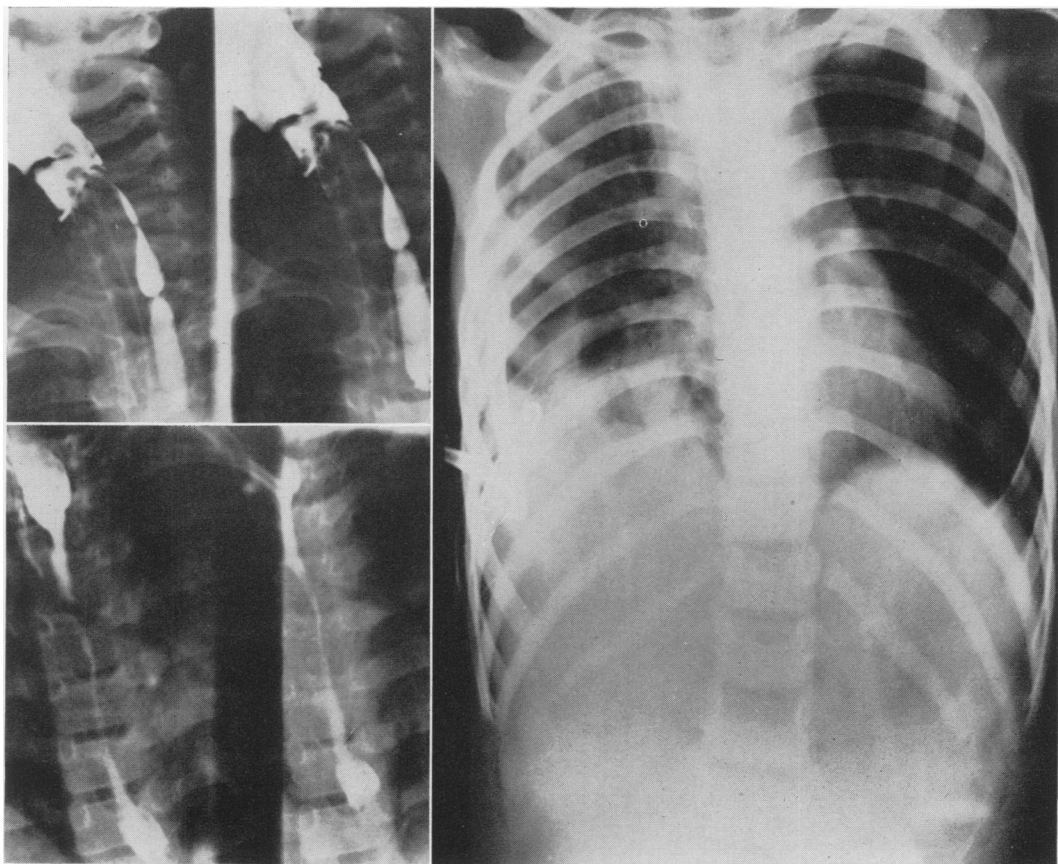


FIG. 10. Lye stricture of the esophagus which was perforated by injudicious attempts at dilatation. Drainage of the right pleural space was instituted and eventually a substitution procedure using colon was accomplished.



and general supportive therapy given. Immediate improvement results from evacuation of the mediastinum and pleura, and closure of the esophagus minimizes the possibility of a persistent fistula which in itself produces a long debilitating illness. In our experience a spontaneous perforation of the esophagus has been successfully closed as late as 28 days following its occurrence and the original treatment consisting only of drainage of the pleural space.

Traumatic esophagoscopy examinations of an edematous inflamed esophagus or unwise attempts to endoscopically remove a foreign body are to be avoided in favor of the safer approach of primary thoracotomy, esophagotomy and removal of the offending foreign body, before the perforation occurs (Fig. 9). Similarly injudicious or persistent attempts to dilate a stricture result in a much higher mortality and morbidity than the apparently more major but safer procedures of thoracic resection or substitution procedures (Fig. 10).

### Summary

1. Perforations of the esophagus are more frequently due to trauma than intrinsic disease. Increasing use of endoscopic procedures and more frequent recognition of spontaneous or postemetic ruptures account for a marked increase in incidence of esophageal perforations in recent years.

2. The recognition of an esophageal perforation depends on an alertness to the significance of severe pain, dysphagia, fever, and elevated pulse rate, together with the presence of air or fluid in the neck, mediastinum or pleura following the ingestion of a foreign body, instrumenta-

tion of the esophagus, vigorous vomiting, trauma to the neck or chest or associated with intrinsic diseases of the esophagus.

3. The mortality of untreated perforations of the esophagus is 70 per cent or more, for those treated by drugs alone from 40 to 70 per cent, and for those treated by drainage and antimicrobial therapy 14 to 20 per cent. Prolonged morbidity at best follows conservative treatment.

4. Closure of the esophageal perforation, even late after infection of the surrounding tissues has occurred, together with drainage, antimicrobial drugs and general supportive therapy results in a low mortality, healing of the perforation and a low morbidity.

5. Advances in the treatment of esophageal perforations with a marked reduction in mortality and morbidity depend on prompt recognition and the early institution of appropriate therapy.

### References

1. Barrett, N. R.: Perforations of the Esophagus and of the Pharynx. *Proc. Roy. Soc. Med.*, **49**:529, 1956.
2. Jermin, E. E.: Results of Treatment of Perforation of the Esophagus. *Am. Surg.*, **128**: 971, 1948.
3. Overstreet, J. W. and Ochsner, A.: Traumatic Rupture of the Esophagus. *J. Thoracic Surg.*, **30**:164, 1955.
4. Samson, P. C.: Postemetic Rupture of the Esophagus. *Surg., Gynec. & Obst.*, **93**:221, 1951.
5. Seybold, W. D., M. A. Johnson and W. V. Leary: Perforation of the Esophagus. *S. Clin. North America*, **30**:1155, 1950.
6. Weisel, W. and F. Raine: Surgical Treatment of Traumatic Esophageal Perforations. *Surg., Gynec. & Obst.*, **94**:337, 1952.