

# Esophageal Perforations and Fistulas:

## Review of 36 Cases With Operative Closure of Four Chronic Fistulas

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THE MANAGEMENT of esophageal perforation has improved significantly over the past 20 years. This has been achieved by earlier diagnosis, more effective supportive therapy and timely operative intervention. Nevertheless, the mortality rate for major injuries to the thoracic esophagus remains substantial, and the patients who survive often suffer prolonged morbidity. The purpose of this communication is to review 36 patients who had either acute esophageal perforation or non-neoplastic chronic esophageal fistulas. The majority of the perforations were instrumental in origin, but others were caused by knife or gunshot wounds, intraluminal foreign bodies, operative accident,<sup>19,23</sup> postmetetic "spontaneous" perforation, or esophageal injury by tracheostomy complications.

Four patients with chronic esophageal fistula were operated upon successfully. Two had recurrent congenital tracheoesophageal fistulas, one an inflammatory esophago-respiratory fistula and one a long-term traumatic esophago-cutaneous fistula.

### Clinical Material

The patients were categorized according to the etiology and the level of esophageal perforation (Fig. 1, Table 1).

*Signs and Symptoms.* The diagnosis of esophageal perforation or rupture was usually suspected on the basis of the presenting signs and symptoms (Fig. 2). The fact

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that these symptoms followed clinical events such as esophago-gastric instrumentation or severe vomiting, known to be associated with the risk of esophageal injury, was especially significant.

Most (92%) of the patients with acute esophageal leakage experienced pain, and the majority (70%) had fever. Dysphagia was a prominent feature in some. Hydrothorax, pneumomediastinum, and pneumothorax occurred variously in different patients. Leucocytosis was present in most patients with acute esophageal perforation. Neck tenderness and crepitation occurred frequently in patients with injury to the cervical esophagus, but this feature was not prominent with injury to the thoracic esophagus. The endoscopist might or not have suspected esophageal injury at the end of the procedure. Lateral films of the neck to exclude sharp bony spurs on the anterior spine were not routinely available.

If the perforation was large and not promptly diagnosed and treated, the patient often presented not only with pain and dysphagia but also with a shock-like state.

*Diagnosis.* The diagnosis of esophageal perforation was not difficult once it was suspected and this suspicion acted upon. Pain, dysphagia, fever and leucocytosis were usually present. Unfortunately, a review of the charts revealed a notable reluctance on the part of the endoscopist, in some cases, to admit to himself that esophageal injury existed and that prompt diagnosis and treatment were imperative. This attitude resulted in excessive delay and less than optimal results upon occasion.

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ETIOLOGY OF ESOPHAGEAL PERFORATION IN 36 CASES

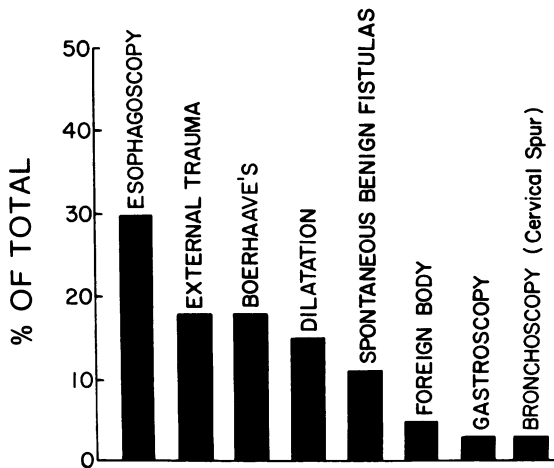


FIG. 1. Instrumentation of the esophagus was the commonest cause of perforation.

The suspected diagnosis of esophageal perforation was usually confirmed by roentgen studies. The plain film often showed mediastinal or cervical emphysema, perhaps with widening of the mediastinum, with or without pleural effusion and pneumothorax. Lateral views of the neck and mediastinum were frequently helpful. However, the most definitive measure was an esophagogram, preferably with water-soluble contrast media. The site of perforation was thus readily identified in most cases, and esophagoscopy was not often employed as an aid in diagnosing esophageal perforation.

Instrumental Perforation

The commonest cause of esophageal perforation was diagnostic or therapeutic instrumentation. It may be seen in Table 1 that there were four cases of endoscopic perforation of the cervical esophagus (one death, 25%) and 16 cases of instrumental perforation of the thoracic esophagus (two deaths, 17%). The higher mortality rate for perforation of the cervical esophagus is misleading, due to the fact that the one death occurred among only

TABLE 1. Etiology of Esophageal Perforation in 36 Cases

Etiology	No. Cases
Instrumentation	16
Endoscopic	11
(Cervical 4)	
(Thoracic 7)	
Dilatation	5
External Trauma	6
Boerhaave's Post-Emetic "Spontaneous"	
Rupture	7
Spontaneous Benign Fistula	5
Foreign Body	2

four patients. In virtually all published series the mortality rate for cervical perforation was low, far lower than that for thoracic perforation. Injury occurred in some patients with a previously normal esophagus, but it was more likely to occur in patients whose esophagus was diseased, perhaps with benign or malignant stricture or achalasia.

Once the diagnosis of esophageal perforation had been established on the basis of symptoms and roentgen studies, broad-spectrum antibiotic coverage was instituted, a nasogastric tube was passed for continuous suction, oral intake was discontinued, intravenous fluid maintenance was begun, and nutritional support was provided to the extent possible. Operative intervention was determined on a variety of bases which included the level of injury, the apparent gravity of the injury (especially when the cervical esophagus was involved) and the probable duration of the injury. If the injury was no "older" than 72 hours, formal thoracotomy and, hopefully, closure of the defect with sutures was favored. However, at times the edges of the esophageal defect were so friable that closure with sutures was not feasible. On the other hand, if the injury was several days old and the patient presented with pleural effusion, a closed thoracostomy tube was inserted for drainage in some patients. In no patient did we resect the involved portion of the esophagus<sup>9</sup> with or without primary anastomosis; nor was the Thal operation<sup>24</sup> or pericardial or lung coverage employed.

To reemphasize, nutritional support<sup>25</sup> was considered to be of critical importance and the routes used included use of a nasogastric tube passed into the jejunum, gastrostomy, jejunostomy, or intravenous alimentation. While gastrostomy might appear to represent a good

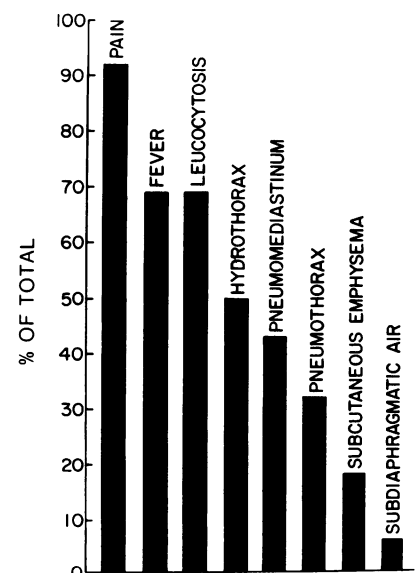


FIG. 2. Pain, fever and leucocytosis are present in the majority of esophageal perforations (16 cases).

route for nutritional support, such feedings may reflux into the esophagus, producing still further intrathoracic contamination.

#### *Injury Due to External Trauma*

The patients who sustained esophageal injury due to external trauma often presented multiple additional injuries and problems. In our series the external injury causes included knife or gunshot wounds, tracheostomy (injury at the operation, or late due to erosion by tracheostomy tube), pulmonary resection, vagotomy, and other intrathoracic procedures. Indeed, the esophagus may be perforated in a remarkably wide variety of situations. Often the esophageal injury represents only one of multiple injuries caused by either blunt or penetrating trauma, but wherever possible the esophageal defect should be closed with sutures and the hemithorax drained with underwater seal.

Esophageal fistulas associated with tracheostomy often terminate fatally. This is due, first, to the fact that the patient is often seriously ill to require a tracheostomy. Secondly, the tracheostomy may become infected by the saliva or other mechanisms, and saliva tends to enter the lungs even though the tracheostomy tube cuff is inflated. Thirdly, it is difficult to achieve closure of an esophageal fistula that complicates a tracheostomy, and the patient is likely to die eventually with pulmonary sepsis, at times further complicated by massive hemorrhage from erosion of the great vessels of the neck.

#### *Intraluminal Foreign Bodies*

Two patients sustained perforation of the cervical esophagus by small bones. No operation other than endoscopic removal of the bone was employed in one patient, whereas surgical drainage of the neck was required in the second patient. Both survived, with only moderate morbidity.

#### *Spontaneous Rupture of Esophagus*

Seven cases of spontaneous rupture due to vomiting were encountered. Three were successfully treated by thoracotomy and suture of the longitudinal laceration at the usual site just above the diaphragm on the left side. The involved mediastinum and left hemithorax were drained with tubes and underwater seal. Two other adult patients died before operation could be attempted and one patient survived without operation. Still another patient was a newborn infant, who survived without operation, and spontaneous perforation at birth has been reported by others.<sup>26</sup> The esophagus was easily sutured in the three patients so treated, and prompt operative intervention is strongly recommended, plus

vigorous supportive therapy before, during and after operation.

#### *Special Cases: Chronic Esophageal Fistulas*

Four patients had chronic acquired esophageal fistulas which were managed by operation. These were sufficiently unusual that they are presented in separate brief case reports.

#### **Case Reports**

**Case 1. Recurrent Congenital Tracheo-Esophageal Fistula With Operative Closure.** Infant A. S. was admitted to University Hospital on 22 April 63. Since birth 2 days earlier he had "spit out" all feedings, and a diagnosis of tracheo-esophageal fistula had been established elsewhere with roentgenograms using contrast medium. At right thoracotomy the blind upper pouch was identified, as was the distal segment of esophagus arising from the trachea. The usual Haight type of anastomosis was performed without difficulty, the chest was closed, and a feeding gastrostomy was performed. He was discharged from the hospital on 3 May 63, after a barium swallow X-ray had disclosed an intact anastomosis without stenosis. He promptly gained weight and thrived. He was later studied for a urinary tract problem, but no esophageal problems arose until December of 1963 when he began to have a cough and frequent respiratory infections. It was found that he had developed an esophageal stricture and esophageal dilatations were initiated with much improvement. Gastrostomy was not re-established. The dilatations were continued until May of 1965, when at esophagoscopy the first author noted that, while there was no significant recurrent stenosis since the last previous dilatation on 26 February 65, a small, thin-walled fistula had developed anteriorly, and anesthetic gas was emerging through this defect. The fistula was about 1 cm. proximal to the old anastomosis.

At right thoracotomy on 28 May 65 the fistula was exposed and divided. The esophagus was closed transversely and the trachea, longitudinally. Available tissue was interposed between the esophagus and trachea to reinforce the suture lines and to prevent recurrence of the fistula.

Thereafter the patient was followed for several years through his family physician, and no further difficulty was reported.

**Comment.** Stenosis and even stricture of the esophageal suture line is not uncommon following repair of congenital tracheo-esophageal fistula. However, recurrence of the fistula has occurred only twice in the senior author's experience. The repeated dilatations very likely contributed to recurrence of the fistula, though the last previous dilatation had been performed three months prior to discovery of the recurrent fistula.

**Case 2. Recurrent Congenital Tracheo-Esophageal Fistula With Operative Closure.** J. W., age 48 hours, was transferred to University Hospital on 25 November 62 with the established diagnosis of congenital tracheo-esophageal fistula. At right thoracotomy the blind proximal esophageal pouch was freed up, the distal esophageal segment was separated from the trachea and the usual Haight repair was performed. There was some tension on the suture line, but the lumen was reasonably satisfactory on barium study prior to discharge (Fig. 3A). A gastrostomy was performed.

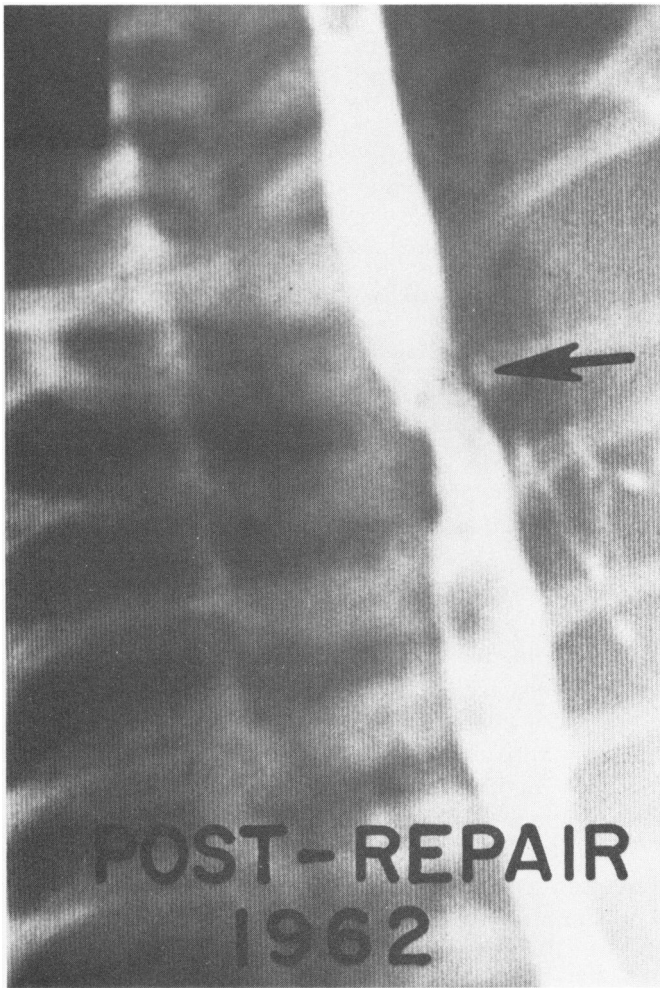


FIG. 3A. Case 2. Esophagogram following repair of tracheo-esophageal fistula at birth.

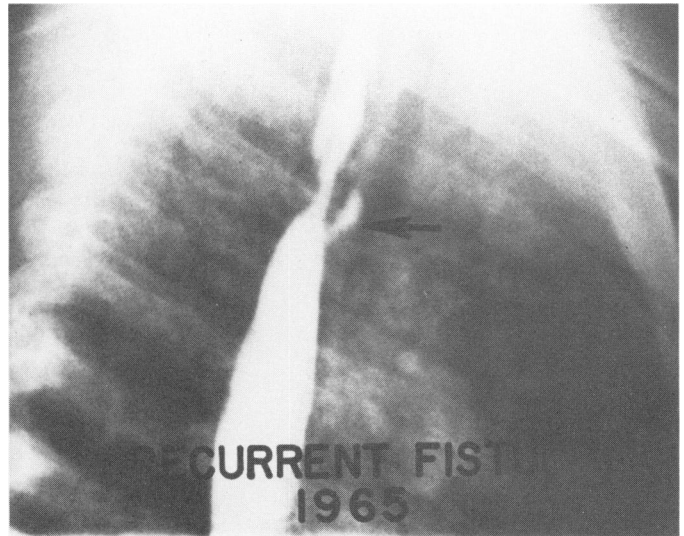


FIG. 3B. Recurrence of the fistula just distal to stricture.

He gained weight and thrived and had no major difficulty until May of 1963. At that time esophagogram disclosed an esophageal stricture, and chest X-ray showed evidence of aspiration pneumonitis. There also appeared to be a possible recurrence of the T-E fistula (Fig. 3B), which was later definitely confirmed radiologically. Dilatations were continued and it was hoped that the fistula might close. Unfortunately, attacks of aspiration pneumonitis became more frequent and severe, and on 29 June 65 the right hemithorax was explored through the old incision with the purpose of closing the defect. The fistula was taken down, the trachea was sutured longitudinally, and available adjacent tissue was pulled over the suture line to prevent opposition with the esophagus. Next, approximately two-thirds of the circumference of the esophageal stricture was excised, with transverse closure of the esophagus through healthy esophageal tissue (Fig. 4A). This gave a good lumen (Fig. 4B) and the patient did well postoperatively.

Over the years since the second operation the patient has grown normally, and is a well developed and well-adjusted ten-year-old schoolboy. He has had occasional dilatations, which he has tolerated readily. He takes a normal diet.

*Comment.* This case constituted the only other instance of late recurrence of a congenital tracheo-esoph-

ageal fistula that had been closed at birth in our hospital. Again, the need for repeated dilatation may have contributed to recurrence of the fistula. However, in this case the dilatations had not adequately relieved the stricture, and the second operation offered the opportunity for resection of the stricture with transverse repair of the esophagus, which organ was now much larger than at birth and permitted a considerably larger lumen. The repeated episodes of pulmonary aspiration and pneumonitis, secondary to the esophageal stenosis which existed preoperatively, were abolished.

*Case 3. Chronic (Instrumental) Esophago-Cutaneous Fistula With Repair.* B. K., a 52-year-old housewife, was transferred to

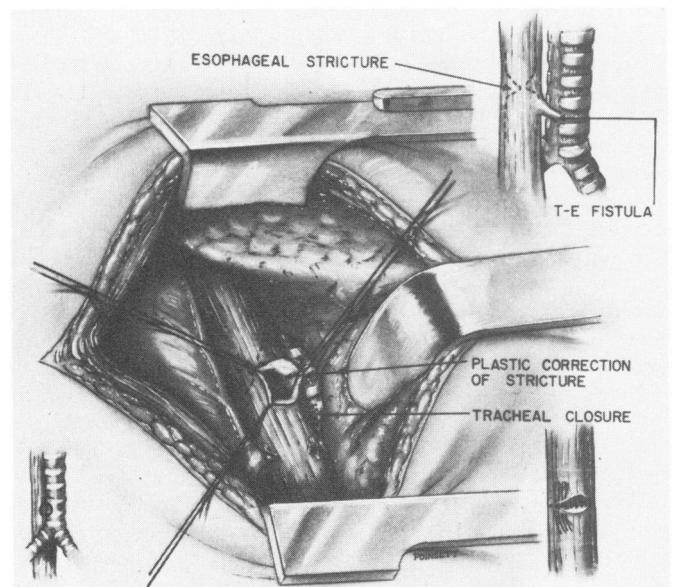


FIG. 4A. Case 2. Operative technic used in correcting recurrent fistula.

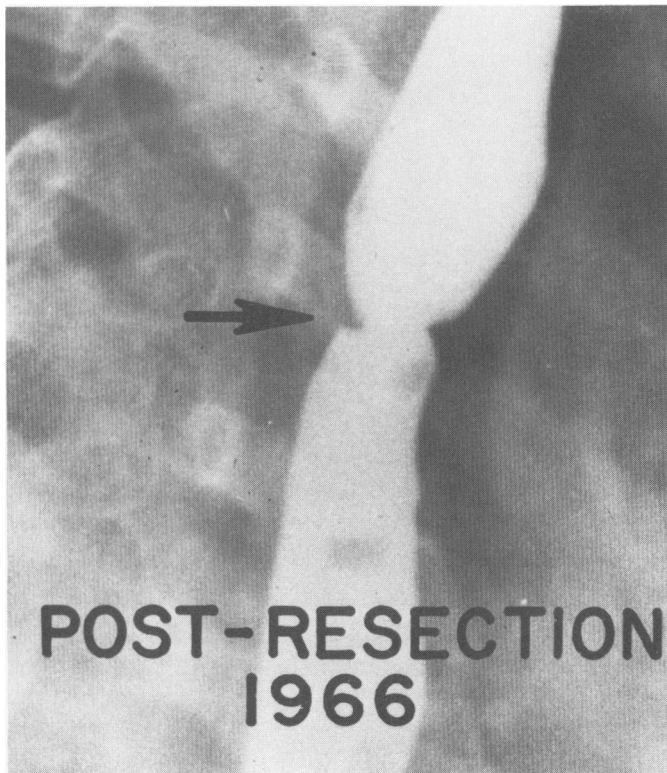


FIG. 4B. Esophagogram following repair of recurrent fistula and excision of two-thirds circumference of esophageal stricture.

University Hospital on 8 June 72 with a right mid-thoracic esophago-cutaneous fistula. It had followed posterior extrapleural surgical drainage of an instrumental perforation of the esophagus at another hospital almost 10 months previously. The original endoscopy had been performed in an effort to diagnose the cause of dysphagia. Gastrostomy feeding had been only partially successful because most of the feeding refluxed into the esophagus and exited through the fistula (Fig. 5A). Her general condition had finally stabilized, but at a very debilitated level.

Repeat barium study showed an esophageal-cutaneous fistula posteriorly. She swallowed the medium without particular difficulty. Repeat endoscopy under topical anesthesia revealed nothing remarkable except the site of the fistula. Since the fistula had not closed in 10 months, operative intervention was selected.

At right thoracotomy on 14 June 72 the fistula tract was followed readily to the esophagus, by virtue of the fact that a Kelly hemostat had been passed down it from the outside. The esophagus was identified above and below the diseased area, and tapes passed around it. It was then opened at the fistulous site, the margins were debrided until good bleeding occurred, and the defect was then closed. An inner mucosal row of 0000 silk inverting sutures was followed by an outer row approximating the muscle layers. A tube drain was placed near the esophageal closure, brought out in extrapleural fashion, and placed beneath a water seal.

The esophagus healed promptly and on 21 June 72 there was no leakage on esophagogram (Fig. 5B). However, on this improved study, made when the contrast medium no longer exited immediately through the previously existing large fistula, it was noted that there might be some pathology in the region of the larynx and upper esophagus, though specific pathology could not be delineated. There was also reverse peristalsis in the lower

esophagus, which was interpreted as perhaps a reasonable explanation for the dysphagia which had prompted the initial endoscopy 10 months earlier. She was allowed to go home for further convalescence from the thoracotomy, to be reevaluated in 2 or 3 weeks.

Unfortunately, soon after arriving home she experienced cervical pain on swallowing and could not take an adequate nutritional intake. At readmission to UMC on 9 July 72 she had become hoarse, and vocal cord paralysis was discovered, cause undetermined. However, elective tracheostomy was performed and then, under general anesthesia and direct laryngoscopy, a laryngeal carcinoma with esophageal invasion was identified by biopsy and frozen section examination. Radiation therapy was initiated.

*Comment.* This patient undoubtedly had a "hidden" laryngo-esophageal, deep-seated carcinoma when first examined in her community hospital, by an experienced endoscopist, 10 months prior to her admission to University Hospital. However, the lesion was missed then and it was missed initially at the University Hospital, at which time she spoke normally and swallowed contrast medium effectively, though with some mild complaint of dysphagia. Even so, on the pre-discharge esophagogram, performed to document satisfactory healing of the surgically closed esophageal defect, the radiologist did raise the possibility of pathologic change just at the laryngo-esophageal junctional level. The fact that abnormal retrograde lower esophageal contractions were described served to confuse the issue.

In sum, however, the esophago-cutaneous fistula, present for 10 months, was readily closed surgically. The diagnosis of invasive laryngo-esophageal carcinoma, while not apparent in her community hospital or on our first examination, was established approximately a month later.

*Case 4. Acquired (Inflammatory) Broncho-Esophageal Fistula With Operative Closure.* M. R., a 50-year-old black woman, was

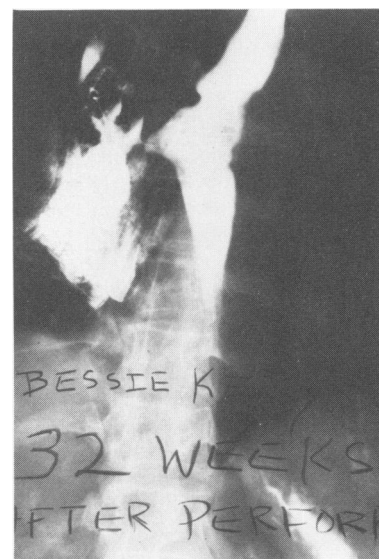


FIG. 5A. Case 3. Esophago-cutaneous fistula 32 weeks after perforation.

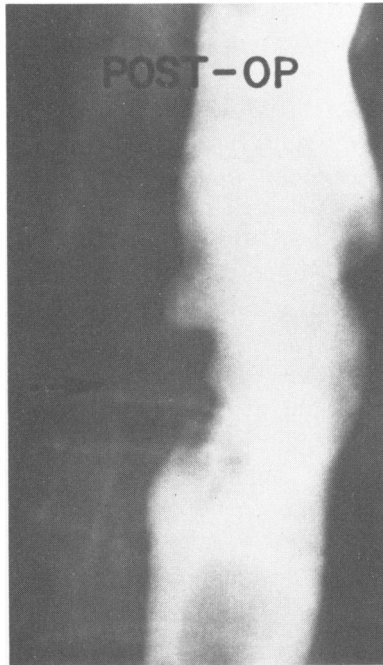


FIG. 5B. Esophagogram a few days following closure of fistula.

admitted to University Hospital on 27 October 61 with a recently re-demonstrated broncho-esophageal fistula. Her family physician included the following sentence in his letter of referral: "She has been under the impression left by the last physician who examined here radiologically in 1953 that she had a carcinoma and as a consequence has been waiting to die."

The recent 1961 films clearly delineated the fistula (Fig. 6A), which her present radiologist correctly interpreted as a non-neoplastic lesion. Esophagoscopy and bronchoscopy were performed on 30 October 61: "The right main stem bronchus was inflamed. Just proximal to the middle lobe bronchus along the posterior-lateral aspect at approximately 4 o'clock, a fistulous opening was identified, which measured approximately 4 mm. in diameter." The fistula was similarly identified in the esophagus, which was friable at this site. A biopsy was taken at a level just above the fistula, which produced considerable bleeding; and there was later evidence that the biopsy had produced a small perforation of the upper esophagus, in addition to the chronic broncho-esophageal fistula.

On 15 November 61 a right posterolateral thoracotomy incision was used to identify and expose the esophagus and the right mainstem bronchus. The exposure was facilitated by identifying the esophagus above and below the fistula by palpating the nasogastric tube in its lumen. The 1 cm. communication between the esophagus and the right main bronchus was then divided, and the bronchus closed longitudinally with silk sutures. Actually, there was remarkable little reaction around the fistula, which was known to have existed for at least 8 years. The esophagus was then closed in two layers, the mucosa being inverted with 000 silk with the knots tied inside the lumen and the muscle layers approximated with similar sutures, tied outside. Pleura and other available tissues were then interposed between the esophageal and the bronchial suture lines. The chest was drained.

The postoperative course was relatively uneventful, but there was a small esophageal leak (Fig. 6B) near the upper end of the suture line which, being well drained, closed without serious difficulty. It was not certain whether this represented a fistula at the proximal end of the suture line, or whether it resulted from the

preoperative esophageal biopsy which had been followed by hemorrhage.

The last follow-up X-rays available were performed on 16 November 70 in her community hospital. The esophagus was normal. She still had the duodenal bulb scarring which had been noted in 1961, there was a small esophageal hiatal hernia, but no pulmonary changes were noted.

*Comment.* This case deserves comment for a number of reasons. First, the socio-economic-medical conditions which existed in the rural Delta area of Mississippi in 1953 have improved enormously over the past 20 years. Specialist groups are available within a short drive in all areas of the state, and most radiology is now performed by trained personnel. Unfortunately, this lady spent a miserable 8 years, from 1953 until 1961, laboring under the erroneous diagnostic impression that she had a malignant esophago-respiratory fistula. However, when she was reexamined in 1961 by a trained radiologist who had located in her community, the benign nature of the lesion was immediately recognized and she was sent to the new University Hospital for surgical closure.

Secondly, the endoscopist at University Hospital was a bit too energetic in biopsying the inflamed and friable esophagus above the fistula, and subsequent events suggested that it had been perforated by the biopsy, though fortunately the cervical defect closed.

Thirdly, it proved to be a relatively simple operation to divide the thoracic broncho-esophageal fistula, and the patient was rehabilitated in a gratifying manner.

### Discussion

*Etiology.* It has been seen that endoscopy causes the greatest number of esophageal perforations.<sup>3</sup> Dilatation

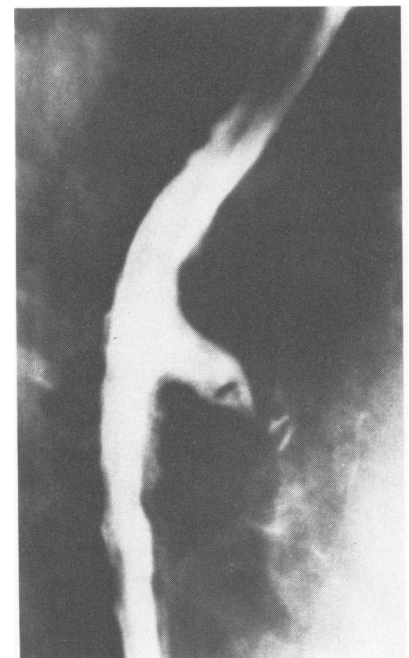


FIG. 6A. Case 4. Esophago-bronchial fistula.

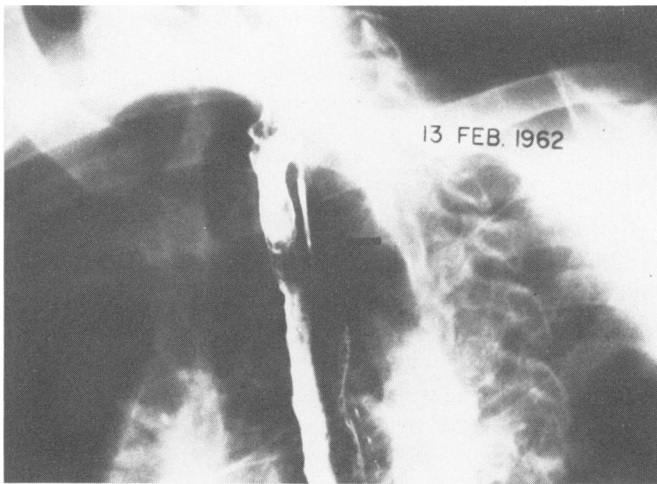


FIG. 6B. Esophagogram a few days after operative closure. Third is a small leak along the drain site, which closed (see text).

of strictures produces another major segment. Following these, spontaneous rupture due to vomiting, intraluminal foreign bodies, penetrating and blunt trauma<sup>27</sup> and numerous other agents contribute additional cases.

The major opportunity for prevention lies in the more safe use of instrumentation. Significant perforation of the thoracic esophagus is such a serious complication that all precautions should be employed. The experienced endoscopist will use the esophagoscope with gentleness, adequate sedation of the patient, advancement of the instrument under direct vision; examine films of neck preoperatively for spurs (though we confess we do not always do so) and desist if the patient cannot relax sufficiently to permit examination. Smith and Tanner<sup>22</sup> noted that both the skill of the examiner and the duration of the examination appeared to be important as regards the incidence of endoscopic perforation. Somewhat surprisingly, they found that the use of general anesthesia did not reduce the incidence of perforation, as compared to topical anesthesia. Difficulty with the examination was cited as an important factor in some clinics, but this had not appeared to be a factor in their series. Predisposing factors are esophagitis and malignant tumors.

We consider esophagoscopy and gastroscopy to be potentially dangerous procedures, though they need not be so. The senior author has almost never perforated the esophagus, though a considerable degree of good fortune must be acknowledged, especially where dilatation of strictures was concerned. The reasons for this are great respect for esophageal injury, caution in passing instruments, postponement of the examination if patient cooperation cannot be achieved, passage of the esophagoscope over an in-lying nasogastric tube if the esophageal opening is hard to identify, great care in taking biopsies of esophageal malignancies, and still other pre-

cautions. Few experiences are more sobering than to manage a patient who is desperately ill from esophageal leakage, following what was to have been a routine endoscopic examination of the esophagus or stomach. More general use of the superb new flexible fiberoptic instruments may further reduce the risk of endoscopic perforation. The incidence of instrumental perforation was recorded by Wychulis, Fontana and Payne<sup>28</sup> as 0.4% in gastrointestinal endoscopic procedures performed at the Mayo Clinic.

*Diagnosis.* The diagnosis of esophageal perforation, when suspected, can usually be established with appropriate roentgenogram and contrast medium. The major opportunity for improved management lies in more prompt diagnosis in patients whose symptoms suggest perforation, for operative closure will be far more successful when performed early than when performed late.

*Management of Instrumental Perforation.* There has appeared to be a considerable divergence of opinion as to the optimal management of esophageal perforation.<sup>6</sup> While most writers recommend thoracotomy as soon as diagnosis is established, Mengoli and Klassen<sup>16</sup> have noted their conservative position by reporting the cases of 21 patients, 18 of whom were treated without operation with only one death, in a patient who had widespread carcinoma. They employed thoracostomy tube drainage, 10,000,000 units of penicillin and one gram of streptomycin daily, and nasogastric tube suction. Three patients had early operation, two having closure of the perforation and one having drainage of a mediastinal abscess. One of the three surgically treated patients died, an 83-year-old man who had been operated upon 3 days after perforation occurred. Hospitalization ranged from 7 to 65 days, with an average of 18 days. Incidentally, they noted that perforation in the presence of malignant tumor had a better prognosis than is generally recognized: five of six such patients had recovered.

As frequently happens, the facts are that most experienced thoracic surgeons individualize treatment, and in a given set of clinical circumstances, or in a given patient, there would probably be considerable agreement on management. Perforation of the cervical esophagus is associated with a low mortality rate and minor perforations are commonly treated successfully with non-operative measures, though surgical drainage of cervical or upper mediastinal abscess will occasionally be required. Intrathoracic esophageal perforations, in contrast, are always serious and potentially lethal. It is in this group that major differences are to be found. Since the results of treatment here are as yet frequently disappointing, it is not surprising that a variety of operative techniques have been employed. These range from simple drainage to formal suture of the perforation plus drainage,<sup>4,5,7,13,17,21</sup> to resection of the perforated

segment,<sup>9</sup> to division of the esophagus with exclusion of the perforated segment,<sup>8,10</sup> to repair of the defect with a flap of stomach<sup>24</sup> or other maneuvers.

The management of spontaneous rupture of the esophagus has been dealt with by us in a previous communication,<sup>2</sup> and by numerous others.<sup>1,4,11,12,14,15,18,20</sup>

The probability for success in the operative closure of chronic esophago-respiratory or esophago-cutaneous fistulas has been emphasized by the case reports presented herein.

### Summary and Conclusions

1. Esophageal perforations and fistulas are associated with substantial morbidity and mortality rates. Injury to the thoracic esophagus is far more serious than injury to the cervical esophagus.
2. Thirty-six patients who had esophageal perforation or non-neoplastic chronic fistulas have been reviewed. Instrumentation accounted for 16 perforations, external trauma 6, Boerhaave's post-emetic rupture 7, and miscellaneous other causes the remainder of the acute perforations.
3. Patients who had sustained acute esophageal perforation almost invariably had pain and usually exhibited fever and leucocytosis. Plain PA and lateral neck and chest films were often helpful, but definitive diagnosis with demonstration of the site of perforation was usually achieved by esophagogram with water-soluble contrast medium.
4. Treatment ranged from non-invasive management in minor perforation of the cervical esophagus, to formal thoracotomy and suture closure of perforation of the thoracic esophagus. There were three deaths in 16 patients who sustained instrumental perforation.
5. Four patients with chronic fistulas, three with esophago-respiratory and one with esophago-cutaneous fistula, were operated upon and the defect closed. Two were children with recurrent congenital tracheo-esophageal fistulas that had been closed at birth.
6. Three of seven patients with spontaneous rupture of the esophagus underwent operative closure and survived. Two died before operation could be performed. The remaining two, one of whom was an infant, survived without operative closure.
7. The hazards of esophago-gastric endoscopy are real. However, it is hoped that with the new fiberoptic instruments, increased experience on the part of the operator, prompt diagnosis of injury, appropriate surgical treatment, and vigorous supportive management the incidence and mortality rates due to esophageal perforation can be reduced.

### References

1. Barrett, N. R.: Spontaneous Perforation of the Esophagus: Review of the Literature and Report of Three New Cases. *Thorax*, 1:48, 1946.
2. Bobo, W. O., Billups, W. A. and Hardy, J. D.: Boerhaave's Syndrome: A Review of 6 Cases of Spontaneous Rupture of the Esophagus Secondary to Vomiting. *Ann. Surg.*, 172:1034, 1970.
3. Briggs, J. N. and Germann, T. D.: Traumatic perforations of the esophagus. *Surg. Clin. North Am.*, 48:1297, 1968.
4. Foster, J. H.: Esophageal Perforations. *Modern Treatment*, 7:1284, 1970.
5. Foster, J. H., Jolly, P. C., Sawyers, J. L. and Daniel, R. A.: Esophageal Perforations: Diagnosis and Treatment. *Ann. Surg.*, 161:701, 1965.
6. Groves, L. K.: Instrumental Perforation of the Esophagus: What is Conservative Management? *J. Thorac. Cardiovasc. Surg.*, 52:1, 1966.
7. Hardin, W. J., Hardy, J. D. and Conn, J. H.: Esophageal Perforations. *Surg. Gynecol. Obstet.*, 124:325, 1967.
8. Johnson, J., Schwegman, C. W. and Kirby, C.: Esophageal Exclusion for Persistent Fistula Following Spontaneous Rupture of the Esophagus. *J. Thorac. Cardiovasc. Surg.*, 32:827, 1956.
9. Johnson, J., Schwegman, C. W. and MaVaugh, H.: Early Esophagostomy in the Treatment of Iatrogenic Perforation of the Distal Esophagus. *J. Thorac. Cardiovasc. Surg.*, 55:24, 1968.
10. Johnson, J., Schwegman, C. W., MaVaugh, H. and Keen, G.: The Surgical Management of Old Esophageal Perforations. *J. Thorac. Cardiovasc. Surg.*, 56:603, 1968.
11. Lillington, G. A. and Bernatz, P. E.: Spontaneous Perforation of the Esophagus. *Dis. Chest*, 39:177, 1961.
12. Lindeboom, G. A.: Herman Boerhaave (1668-1738): Teacher of All Europe. *JAMA*, 206:2297, 1968.
13. Loop, F. D. and Groves, L. K.: Esophageal Perforations. *Ann. Thorac. Surg.*, 10:571, 1970.
14. Mackler, S. A.: Spontaneous Rupture of the Esophagus: An Experimental and Clinical Study. *Surg. Gynecol. Obstet.*, 95:345, 1952.
15. Mathewson, C., *et al.*: Clinical Experiences with Perforation of the Esophagus. *Am. J. Surg.*, 104:257, 1962.
16. Mengoli, L. R. and Klassen, K. P.: Conservative Management of Esophageal Perforation. *Arch. Surg.*, 91:238, 1965.
17. Nealon, T. F., Jr., Templeton, J. Y., III, Cuddy, V. D. and Gibbon, J. H., Jr.: Instrumental Perforation of the esophagus. *J. Thorac. Cardiovasc. Surg.*, 41:75, 1961.
18. Olsen, A. M. and Clagett, O. T.: Spontaneous Rupture of the Esophagus: Report of a Case with Immediate Diagnosis and Successful Surgical Repair. *Postgrad. Med. J.*, 2:417, 1947.
19. Postlethwait, R. W., Kim, S. K. and Dillon, M. L.: Esophageal Complications of Vagotomy. *Surg. Gynecol. Obstet.*, 128:481, 1969.
20. Sampson, P. C.: Post-emetic Rupture of the Esophagus. *Surg. Gynecol. Obstet.*, 93:221, 1951.
21. Seybold, W. D., Johnson, M. A., III and Leary, W. V.: Perforation of the Esophagus: An Analysis of 50 Cases and an Account of Experimental Studies. *Surg. Clin. North Am.*, 30:1155, 1950.



22. Smith, C. C. K. and Tanner, N. C.: The Complications of Gastroscopy and Esophagoscopy. *Br. J. Surg.*, 43:396, 1955-56.
23. Takaro, T., Walkup, H. E. and Okano, T.: Esophagopleural Fistula as a Complication of Thoracic Surgery: A Collective Review. *J. Thorac. Cardiovasc. Surg.*, 40:179, 1960.
24. Thal, A. P. and Hatafuku, T.: Improved Operation for Esophageal Rupture. *JAMA*, 188:826, 1964.
25. Tuttle, W. M. and Barrett, R. J.: Late Esophageal Perforations. *Arch. Surg.*, 86:695, 1963.
26. Wiseman, H. J., Celano, E. R. and Hester, F. C.: Spontaneous Rupture of the Esophagus in a Newborn Infant. *J. Pediat.*, 55:207, 1959.
27. Worman, L. W., Hurley, J. D., Pemberton, A. H. and Narodick, B. G.: Rupture of the Esophagus from External Blunt Trauma. *Arch. Surg.*, 85:333, 1962.
28. Wychulis, A. R., Fontana, R. S. and Payne, W. S.: Instrumental Perforations of the esophagus. *Dis. Chest*, 55:124, 1969.

#### DISCUSSION

DR. JOHN H. FOSTER (Nashville): Some years ago, in the early 1960's, John Sawyers and I had the privilege of reviewing esophageal perforations at Vanderbilt with Dr. Rollin Daniel, and presented them before this Association. The findings were very much the same then as presented today; most of perforations were due to instrumentation. But as Dr. Hardy indicated, with the fiberoptic scopes used today, we are doing more endoscopic examinations, I think, than ever before; and yet we are rarely seeing esophageal perforation.

It was always of interest to me how the endoscopist, using the rigid metal scopes, did not recognize the fact that he had injured the esophagus. The most interesting case in our series was one in which the scope exited from the esophagus in the cervical region, went down the mediastinum and into the abdomen through the esophageal hiatus.

A couple of years ago, shortly after we published our paper, one was published in the *JAMA* advocating conservative therapy—nonoperative—for instrumental perforation of the esophagus. I have not heard any more of that report recently, but it certainly goes against everything I believe, and I am sure Dr. Hardy is in agreement.

One final thing I would say is that, in some of the horrendous perforations, especially of the spontaneous perforations, drainage is the absolute essential mode of management. If you can close the perforation, fine; but drainage is the real key factor. With total parenteral alimentation today, I believe it will be possible to manage these patients much more successfully.

DR. FREDERICK H. TAYLOR (Charlotte): I would certainly agree that the flexible esophagoscope is a much safer instrument, as far as perforation is concerned. At times we must use the rigid scope, and the preoperative insertion of a nasogastric tube seems to protect the posterior wall of the cervical esophagus from injury.

When instrumental perforation of the esophagus does occur, an immediate diagnosis is sometimes possible, and this enables not only repair and drainage of the injury, but also simultaneous correction of the underlying disease.

In two patients with hiatal hernia in whom the diagnosis of instrumental perforation was made immediately, the perforations were repaired, and the hernias corrected without complication. In two other patients with chronic esophageal strictures, in whom perforation had occurred as a result of dilatation, both were seen by us within 2 hours, and underwent resections of the lower esophagus, esophagogastric anastomosis, and pyloroplasty.

[Slide] This was a chronic stricture from an old lye burn with perforation, which was diagnosed within 2 hours after the injury.

[Slide] This is the specimen of the stricture, the location of the perforation.

One other point I would like to make: Having successfully defended a malpractice suit following instrumental perforation of the esophagus, I am well aware of the legal complications of this problem. The matter of informed consent is becoming increasingly important in malpractice suits.

[Slide] I hasten to add that this series is not a personal one but it is gathered from the literature. I am sure no one tells a patient of all these possibilities, but I would like to ask Dr. Hardy one question: What do you tell a patient when obtaining permission for esophagoscopy?

DR. JOHN B. BLALOCK (New Orleans): I would like to make two comments. The first is to cite an instance of a broncho-esophageal fistula due to a broncholith. The patient had coughed up a broncholith. The opening of the fistula was visualized by bronchoscopy and by esophagoscopy. This was demonstrated by a Dionosil swallow, with the outlining of the left lobe of the bronchus [slide].

[Slide] This is the operation from the right side with one probe in the left main stem bronchus, the other in the esophagus, and they were repaired as Dr. Hardy did in his patient.

My next comment is that in five instances at Ochsner Clinic we have successfully performed a definitive procedure at the time of operation for an instrumental perforation of the esophagus. Four of these were resections of either a carcinoma or a stricture, and the fifth was in a case of achalasia. In the latter patient the esophagus had been ruptured by the Mosher dilator. This is viewed from the left side [slide]. Dr. William McKinnon of our department repaired the esophagus, and proceeded to perform the Heller procedure on the opposite side of the esophagus.

[Slide] The view on your right shows the satisfactory post-operative result.

We feel that when a subsequent operation is inevitable, it may well be possible to perform this operation at the time of operation for perforation.

DR. ROBERT P. MCBURNEY (Memphis): I would like to mention cervicoesophagotomy, a procedure which I think is quite useful in these instances: a large perforation with much sepsis or in the case which is late, and comes to you with draining empyema and fistulas, in which it is difficult or unwise to dive right in and start working on the perforation. This was brought to my attention about 15 years ago, when I had occasion to see a patient on charity service at Baptist Hospital in Memphis. When I assumed charge of the service, this patient had been operated on twice for attempted closure of a traumatic perforation of the esophagus with tracheoesophageal fistula. Both procedures had failed, had broken down, and this young man, who was just 19, had been reduced to the nutritional status of a person who appeared to have been in one of Hitler's concentration camps. It looked as though death was about to occur.

First, we performed a cervicoesophagotomy, completely bypassing the esophageal secretions. I think this is helpful in many cases, because often by just putting a nasogastric tube down into the esophagus it does not really completely eliminate the supply of drainage and other material out through the fistula. This procedure plus gastrostomy turned this boy around, and then at a later date we were able to do an esophagocologastrostomy, constructing a new esophagus for him. I felt that this would probably be better than making a third attempt to operate in the area of the tracheoesophageal fistula.