

Improved Management of Esophageal Perforation:

Exclusion and Diversion in Continuity

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Gastroesophageal reflux interferes with healing of esophageal perforations and prolongs the associated complications of esophagitis, mediastinitis, empyema and persistent fistula. Esophageal exclusion and diversion in continuity, in addition to closure, drainage, nutritional support by gastrostomy or hyperalimentation, and antibiotic therapy, are advocated for most esophageal perforations particularly when diagnosed late. Preservation of the esophagus in continuity facilitates definitive restorative or reconstructive procedures at a time of election.

ESOPHAGEAL PERFORATION is associated with a high risk of morbidity and mortality,^{2,3,7} particularly if not recognized early or proper therapy instituted promptly. In spite of improvement in results with early suture of perforation, mediastinal and pleural drainage, and antibiotic therapy, recurrence or persistence of the fistula with the associated high morbidity and mortality remains a problem in many cases. Reflux of pepsin, acid, or bile into the esophagus and extravasation into the mediastinum aggravates inflammation, propagates the pathology and interferes with healing.

Recognition of the importance of gastroesophageal reflux in many patients with esophageal perforation has led to an improved operative approach: 1) *exclusion* of the esophagus by ligation of the cardia to prevent gastroesophageal reflux, and 2) *diversion* in continuity of oral secretions by cervical esophagostomy, in addition to prompt closure of perforation, drainage of the mediastinum and pleura, tube gastrostomy, antibiotic therapy and nutritional support.

Following an interval to allow healing of the esophagus and subsidence of mediastinitis, which are accelerated

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by exclusion and diversion, the esophagus is preserved for restorative or reconstructive procedures. Exclusion and diversion can be applied initially for perforation of thoracic esophagus which are large or recognized late, or can be instituted after failure of standard treatment.

The purpose of this paper is to report experience with six cases of esophageal perforation treated by esophageal exclusion and diversion with reduced morbidity and mortality.

Clinical Material

The value of esophageal exclusion and diversion in continuity in traumatic esophageal perforations is demonstrated in six selected patients. Two patients had perforations secondary to dilatation for esophageal strictures, associated with hiatal hernia and gastroesophageal reflux; two had spontaneous or postemetic perforations; and two patients had associated tracheal injuries, one as a result of closed rupture and the other as a result of a penetrating missile wound. Exclusion and diversion procedures were done initially in three cases and at a later stage because of persistence of a fistula in spite of adequate drainage and nutritional support in the remaining three patients. All patients improved promptly after institution of exclusion and diversion procedures and the perforations healed. Restorative or reconstructive procedures of the esophagus can be done after an interval to permit resolution of esophagitis, mediastinitis and pleural complications.

The value of exclusion and diversion in reduction of

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morbidity and mortality suggests its employment initially in most perforations of the esophagus, particularly those involving the thoracic portion. Two case reports demonstrate the value of this procedure performed later after failure of standard therapy in one and initially in the other.

Case Reports

Case 1. A 65-year-old mildly diabetic woman underwent esophagoscopy elsewhere for an episode of meat impaction in the lower esophagus. A large right esophageal perforation resulted which subsequently produced mediastinitis and right empyema. A tube thoracostomy drainage was instituted following the diagnosis of a perforation. Because of failure to improve, the patient was transferred for further treatment five days following perforation. The patient was known to have had an esophageal hiatal hernia, symptomatic gastroesophageal reflux and stricture for 15 years. Examination revealed an extremely ill, dehydrated, malnourished woman with a temperature of 104° F and elevated pulse rate. Roentgenograms demonstrated a perforation of the esophagus above a stricture in the lower third of the esophagus with mediastinal and pleural involvement. Drainage of the right pleura and mediastinum was established and gastrostomy performed. No attempt was made to close the perforation because of severe esophagitis and mediastinitis. The esophagus was shortened, edematous, and fibrotic. The patient improved with adequate drainage but remained febrile and persistently ill with foul drainage from the mediastinum and pleura.

Two weeks after admission, because of the persistent fistula, the esophagus was excluded and diverted by placement of two umbilical tape ligatures at the cardia through a small abdominal incision and cervical esophagostomy in-continuity.

The patient's condition improved rapidly in a few days with a normal temperature and markedly diminished drainage from the mediastinum and pleura. With nutritional support by means of gastrostomy, the patient gained weight and was discharged to await healing of the fistula.

After an interval of three months, during which the fistula had healed and the mediastinal and pleural complications resolved, the patient was re-admitted to the hospital for definitive treatment. Through a left thoracotomy the esophagus appeared normal although shortened. The severe esophagitis previously observed had resolved, and the esophagus could be dissected free with minimal difficulty. The exclusion ligatures at the cardia were identified and removed. Through a small gastrostomy opening it was demonstrated that the stricture originally observed by x-rays and esophagoscopy had disappeared.

A Collis gastroplasty^{1,8,9} lengthening the functioning esophagus by approximately 5 cm and a Belsey-type reconstruction of the new cardial angle were performed to prevent gastroesophageal reflux. The cervical esophagostomy was dissected free and closed, thus restoring the continuity of the esophagus. The patient's post-operative course was uneventful and she was discharged about one week later with normal swallowing function. Two years later, cinefluorography of the esophagus revealed normal function with no gastroesophageal reflux or stricture.

Case 2. A 32-year-old woman sustained a large lower esophageal perforation secondary to esophagoscopy for dilatation of stricture, performed elsewhere. She had had difficulty swallowing since childhood and the diagnosis of short esophagus and stricture had been made. She had longstanding symptoms of heartburn, indigestion, regurgitation and dysphagia. Multiple dilatations of a lower esophageal stricture 5 cm in length had been done pre-

viously. Following the last dilatation, a perforation was suspected and the patient was given barium to confirm the diagnosis. Large quantities of barium extruded into the mediastinum and retroperitoneal space. She was transferred to the thoracic surgical service eight hours following perforation, extremely ill with a temperature of 104° F.

Following rehydration and antibiotic therapy, through a left thoracotomy a 5 cm long tear beginning above the stricture and ending approximately 1 cm above the cardia was found and sutured. Because of the known presence of gastroesophageal reflux, the distal esophagus was ligated with umbilical tape below the perforation at the cardia. The mediastinum, pleura and retroperitoneal space were drained. It was impossible to remove all of the barium. Gastrostomy and a cervical esophagostomy in-continuity were performed. Following these procedures the patient improved rapidly and she was discharged from the hospital with drainage tubes in the mediastinum and in the retroperitoneal space. A second drainage procedure for retroperitoneal abscess from barium extravasation was required, although her perforation had healed.

Six months later, following healing of the mediastinal and subphrenic abscesses, the esophagus was examined by cinefluorography revealing a patent lower esophagus. A definitive operation was performed through a left thoracotomy. Inflammation was minimal in the area of the previous perforation and the esophagus was easily dissected free and the umbilical tape removed from the cardia. Through a transverse gastrostomy at the cardia, an effort was made to dilate the longitudinal stricture. This was impossible because of severe fibrosis throughout the wall of the esophagus. Local resection and a short colon interposition were performed. An isoperistaltic segment of transverse colon based on the middle colic artery was employed, providing a sufficiently long intraabdominal segment of colon to prevent gastroesophageal reflux. A pyloroplasty was performed and the cervical esophagostomy was closed. The patient recovered uneventfully following these operations with a markedly improved swallowing mechanism superior to any she could remember.

Examination at one year revealed continued satisfactory function of the colon interposition by cinefluorography in a patient without symptoms.

Comment

Case 1 illustrates the persistence of an esophageal fistula and its complications in the presence of known gastroesophageal reflux. Exclusion and diversion in-continuity done late permitted the fistula to heal and the severe esophagitis and stricture to resolve. Definitive restoration of esophageal continuity was thus made possible, utilizing a Collis gastroplasty.

Case 2 illustrates healing of a perforation after closure, drainage, and esophageal exclusion with diversion in-continuity done initially in spite of obstruction distal to the perforation in a patient with a long history of gastroesophageal reflux. Elective definitive reconstructive colon interposition was necessary to restore esophago-gastric continuity because of a fibrotic stricture.

Esophageal exclusion and diversion procedures were done initially in addition to closure and drainage for two patients with spontaneous postemetic perforations, after 8 hours in one and 12 hours in the other. Primary healing

was demonstrated in both within two weeks, at which time patency of the lumen was demonstrated in both patients.

One patient sustained closed rupture of the esophagus and trachea in-continuity and was initially treated conservatively because of an error in diagnosis. After a tracheoesophageal fistula became evident, esophageal exclusion and diversion were performed, permitting eventual operative closure of the fistula with restoration of continuity of the esophagus.

The last patient sustained a missile wound of the esophagus and trachea necessitating closure of the tracheal wound and suture of the distal end of the severed esophagus. The distal esophageal segment failed to heal requiring eventual exclusion, diversion of the divided esophagus having been performed originally. Healing of the fistula in the distal end reverted and a reconstructive procedure is being planned.

Technique

Esophageal Exclusion and Diversion In-continuity

At the initial thoracotomy, the esophageal perforation is sutured, mediastinal and pleural drainage instituted, and an umbilical tape inserted around the esophagus over a piece of Teflon felt below the perforation and above the cardia and deep to the vagus nerves (Fig. 1). The Teflon felt band is sutured and the ligature tied firmly but with care to avoid strangulation of tissue. Initially, this prevents reflux of gastric contents into the esophagus and the area of perforation. Later, in three of six cases, a minimal lumen within the ligature has been demonstrated by water soluble contrast material after the perforation has healed and the edema and inflammatory reaction have subsided. A gastrostomy is constructed in the left upper quadrant of the abdomen.

Diversion is accomplished by mobilization of the cervical esophagus in-continuity, care being taken to preserve the blood supply and avoiding injury to the recurrent laryngeal nerves. A longitudinal or oblique incision, approximately one and one-half centimeters in length, is made in the esophageal wall and the muscularis and mucosa are sutured to the subcutaneous fascia and skin with interrupted 4-0 silk (Fig. 1).

Interval closure is effected easily by dividing the esophageal cutaneous suture line, minimally mobilizing the esophagus and closing the esophagostomy transversely with two layers of interrupted 4-0 silk sutures. The technique for diversion is simple, expedient, avoids compromise of the esophageal lumen and has the advantage of preserving the esophagus in continuity.

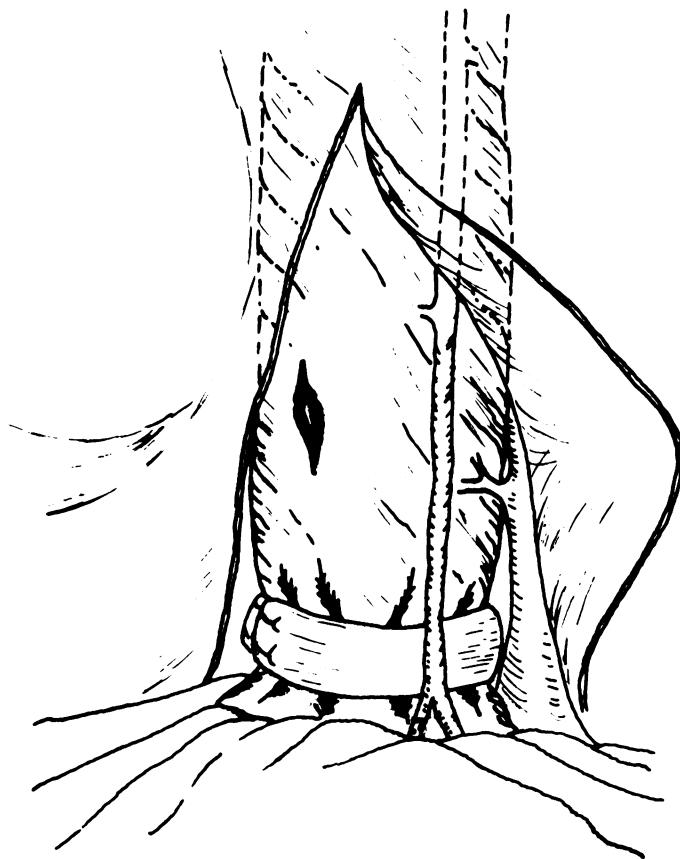


FIG. 1a. Ligature is placed on the esophagus above the cardia, below the perforation, and deep to the vagus nerve.

Definitive Restorative or Reconstructive Procedures

At a time of election after improvement of nutrition and healing of the perforation, a left thoracotomy is performed. The esophageal ligature is removed with ease and a transverse gastrotomy made in the stomach approximately one centimeter below the cardia. The esophageal lumen is examined and if a stricture is present, it is dilated in retrograde fashion or perorally using a Hegar dilator or Maloney bougie. Esophageal lengthening can be achieved by a Collis gastroplasty if necessary, combined with a Belsey type reconstruction of the new cardia to prevent gastroesophageal reflux.

If the stricture is fibrotic and cannot be dilated, it can be resected and a short segment of transverse colon



FIG. 1b. Cervical esophagostomy in continuity sutured to subcutaneous tissue and skin.

mobilized and interposed to restore esophagogastric continuity. The interposed segment of colon extends well into the subphrenic region, being anastomosed to the posterior wall of the stomach approximately one-third of the distance distally from the cardia to prevent gastrocolic reflux. Concomitant pyloroplasty is necessary as a drainage procedure because of the vagotomy associated with the resection. The gastrostomy tube is left in place for two to three weeks following this procedure and may be removed as an outpatient procedure.

For patients without stricture, a procedure to prevent reflux should be performed, employing the Collis gastroplasty to provide additional length if it is necessary.

Discussion

Gastroesophageal reflux of acid pepsin or bile interferes with healing of esophageal perforations and prolongs the associated complications of esophagitis, mediastinitis, empyema and persistent fistula, resulting in high morbidity and mortality. Recumbency, any obstruction at the pylorus, or incompetency of the esophageal sphincteric mechanism result in greatly increased regurgitation into the esophagus. A patient with any degree of tolerable reflux may have an exacerbation of its consequences in association with gastrointestinal upset, pain or confinement to bed by trauma, or other illness. Recumbent reflux is increased by an in-lying nasogastric tube through a patulous cardia, particularly in the comatose, narcotized, postoperative or acutely ill patient with underlying gastroesophageal disease or trauma.

Esophageal exclusion and diversion in-continuity prevents gastroesophageal reflux and diverts the flow of oral secretions. Performance of these procedures in continuity preserves the esophagus and facilitates definitive restorative or reconstructive procedures. In addition, severe esophagitis and strictures may be reversible by prevention of reflux of acid pepsin or bile.

Previously reported exclusion procedures have been total in that the esophagus has been interrupted and closed⁴ thus sacrificing or, at best, jeopardizing definitive reconstructive procedures. Resection of the perforation and esophagogastronomy as previously advocated for^{5,6} perforations proximal to an obstructive lesion are associated with a high early mortality risk, and later this risk

may be prohibitive. Exclusion in continuity may be done early or late with lower risk and severely infected areas avoided, even in the presence of obstruction by distal strictures.

Although cervical and small perforations in the thoracic esophagus may heal with drainage and antibiotic therapy with or without closure, exclusion and diversion in continuity may well be indicated in most larger perforations of the thoracic esophagus. The morbidity and mortality of these perforations being high, it seems reasonable to add exclusion and diversion in continuity to closure and drainage to permit primary healing, shortened morbidity and lower mortality risk. The esophagus is thereby preserved and definitive restorative or reconstructive procedures can be done at a time of election.

Conditions other than traumatic perforations of the esophagus which may benefit by esophageal exclusion are severe bleeding from esophagitis secondary to gastroesophageal reflux, esophageal fistula following pneumonectomy, and congenital or acquired tracheoesophageal fistula.

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DISCUSSION

DR. JOHN L. SAWYERS (Nashville): I congratulate Dr. Urschel on a very significant paper on the management of esophageal perforation, which continues to be a very challenging problem.

When I first read this abstract, I thought this appeared to be a very aggressive approach to the management of esophageal perforations, but after reviewing our experience with sixty-four pa-

tients who sustained an esophageal perforation, I think that our data supports this aggressive approach.

We found that the incidence of esophageal perforation secondary to trauma and to spontaneous rupture has increased during the past decade, but the number of iatrogenic perforations, especially from esophageal instrumentation, has decreased.

The necessity for early diagnosis and aggressive management is apparent from mortality figures, which in our experience, were