

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 esophagogastrostomy 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.

References

1. Collis, J. L.: An operation for Hiatus Hernia with Short Esophagus. *Thorax*, **12**:181, 1957.
2. Groves, L. K.: Instrumental Perforation of the Esophagus. What Is Conservative Management? *J. Thorac. Cardiovasc. Surg.*, **52**:1, 1966.
3. Hardy, J. K.: Esophageal Perforations and Fistulas: Review of 36 Cases with Operative Closure of Four Chronic Fistulas. *Ann. Surg.*, **177**:6, 1973.
4. Johnson, J., Schwegman, C. W. and Kirby, C. K.: Esophageal Exclusion for Persistent Fistula Following Spontaneous Rupture of the Esophagus. *J. Thorac. Cardiovasc. Surg.*, **32**:827, 1956.
5. Johnson, J., Schwegman, C. W. and MacVaugh, H., III: Early Esophagogastrostomy in the Treatment of Iatrogenic Perforation of the Distal Esophagus. *J. Thorac. Cardiovasc. Surg.*, **55**:1, 1968.
6. Kerr, W. F.: Emergency Oesophagectomy. *Thorax*, **23**:204, 1968.
7. Paulson, D. L., Shaw, R. R. and Kee, J. L.: Recognition and Treatment of Esophageal Perforations. *Ann. Surg.*, **152**:1, 1960.
8. Urschel, H. C. and Paulson, D. L.: Gastroesophageal Reflux and Hiatal Hernia. *J. Thorac. Cardiovasc. Surg.*, **53**:21, 1967.
9. Urschel, H. C., Razzuk, M. A., Wood, R. E., Galbraith, N. F. and Paulson, D. L.: An Improved Surgical Technique for the Complicated Hiatal Hernia with Gastroesophageal Reflux. *Ann. Thorac. Surg.*, **15**:443, 1973.

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

13 per cent for patients treated within twenty-four hours of the perforation, but rose to 56 per cent mortality for patients who had a delay beyond twenty-four hours before initiation of treatment for esophageal perforation.

Location of the esophageal perforation was an important factor in prognosis, as none of our treated patients with a perforation of the cervical esophagus died, in contrast to a 35 per cent mortality rate for perforations of the thoracic and abdominal esophagus. Improved aggressive management of esophageal perforation, as outlined by Dr. Urschel and his associates, may help to lower this mortality rate.

I would like to ask him if he thinks that this new method of treatment is necessary for perforations that are recognized early—say, within the first eight hours?

DR. PAUL ADKINS (Washington, D. C.): I rise to offer, perhaps, an alternative method of management for the intermediate phase of esophageal perforations. I think most of us would agree that in the patient who has a relatively normal or nonstrictured esophagus, if they can be operated upon early, in the first six to eight hours, primary closure yields reasonably good results. On the other hand, the period from eight to eighteen or twenty-four hours is a grey area, and in lieu of the multiple, staged procedures that Dr. Urschel has discussed, we have had some experience with the Thal fundic patch in this situation, and we believe it has considerable merit.

(Slide) I believe most of you are familiar with this patch procedure. It utilizes the fundus of the stomach, sutured after widely opening the area of perforation. It has the advantage of allowing you to debride the edematous and friable esophagus adjacent to the perforation, cutting back to normal esophagus, and then bringing the fundus of the stomach up as a patch, even in those patients who have some degree of preexisting stenosis, without having to worry about compromising the lumen of the esophagus in achieving a closure.

(Slide) This shows the suture of the fundic patch over the esophageal opening. Again, you can cut back to half or more of the lumen of the esophagus, utilizing the fundic patch for closure, and still retain an adequate lumen. This can be ensured by passing a large dilator down through the esophagus at this stage, and assuring that you have a satisfactory lumen during the closure.

(Slide) We would agree with Dr. Urschel thoroughly that elimination of esophageal reflux is an important consideration in the management of this problem, and consequently, in contradistinction to early experiences with the fundic patch, in which the patch alone was used, we believe that in addition to the patch, a fundoplication or more of the stomach should be brought up around not only the patch, but above the patch, in this fashion, so that one not only eliminates or minimizes reflux, but you in addition have an insurance policy in terms of the secure closure of your esophageal perforation.

We have had the opportunity in recent years to use this on six patients, one with a spontaneous rupture and give with instrumental perforations of the distal portion of the esophagus. One patient died, not from empyema, but died in the hospital of a coronary occlusion. The remaining five patients survived, did well, with minimal or no reflux, and no significant other complications.

So we would recommend this as an alternative procedure in the patient operated upon, between eight and eighteen hours after the perforation. Three of these six patients that we operated on were over eight hours following the perforation, and the longest was eighteen hours, and all this group did well. So we believe this offers a single, definitive operative procedure in the management of this situation, at least in the first twenty-four hours.

DR. MARK M. RAVITCH (Pittsburgh): I think this is too much surgery to do in a staged procedure, in spite of the good results. This is, of course, the application in 1973 of the procedure which Dr. B. N. Garter of Cincinnati employed for congenital tracheoesophageal fistula about 1941.

It is our practice on the very early cases either to suture the laceration or the rupture or to perform a definitive operation, as suggested by Dr. Adkins.

In the late cases—and I have only got two to talk about—with a great, big, dirty hole and empyema, there is nothing simpler than to put a large mushroom catheter right into the esophagus through the opening, put a drain alongside of it, and come out. You will get an esophageal fistula which will clear without much of a problem, and this is a single operation. If one then needs a secondary procedure some time in the future, one can consider it, but one isn't forced to it.

DR. DONALD L. PAULSON (Closing discussion): I appreciate Dr. Sawyers' remarks in supporting our thesis and pointing out the high mortality for perforations of the thoracic esophagus—in his series, 15 per cent—and in many of these cases, even though the patient survives the acute emergency, the morbidity can be excessive.

Mr. Barrett of England many years ago called attention to the fact that even though the patient survived the acute emergency, he may get into a chain of events with irretrievable complications which may eventually cause his death.

We agree with Dr. Adkins and Dr. Ravitch that closure immediately and, if possible, a definitive procedure at that time be done, but what we are talking about are perforations above an obstruction diagnosed late. In the two cases Dr. Urschel detailed for you, the accepted treatment heretofore has been resection, esophagogastrectomy and esophagogastronomy because of the obstruction below the perforation. In these patients in whom the perforation occurred proximal to benign strictures due to gastroesophageal reflux, we have been impressed that by simple ligation of the cardia in continuity, reflux was prevented with resulting resolution of the severe esophagitis present and healing of the perforation or fistula.

We then applied this for the spontaneous perforations, and I think we would all, if we have had much experience with spontaneous perforations, have had the experience of closures of these perforations reopening several days after closure. Unfortunately, we do not see them all within the first six or eight hours, the diagnosis being delayed in many cases.

We believe that esophageal exclusion and diversion in continuity is advantageous in that the esophagus is preserved. It's an expedient procedure to correct the reflux and to permit healing. In many cases the sutured perforation may remain closed for several days only to reopen secondary to gastroesophageal reflux. It makes little difference whether the patient has gastroesophageal reflux before his traumatic perforation or not. With any illness or trauma, the consequences of reflux through a patulous cardia are apt to be exacerbated in association with gastrointestinal upset, mediastinitis, pain and confinement to bed. Furthermore, recumbent reflux may be increased by a tube through the patulous cardia, particularly in the comatose, narcotized, postoperative or acutely ill patient with underlying gastroesophageal disease or trauma.

We are aware, of course, that esophageal exclusion in continuity has been used before for congenital tracheoesophageal fistulas and as a complete or total exclusion (with division and suture of the esophagus) for persistent fistulas following spontaneous rupture, as reported by Johnson, Schwegman and Kirby. We are impressed, however, that by simple ligation exclusion and diversion of the cervical esophagus in continuity there are obvious advantages of preservation of the esophagus permitting it to be used in definitive reconstructive procedures. In addition, the consequent lowering of morbidity and mortality obviously answers any objections to multiple procedures.

We would advocate that exclusion and diversion in continuity be considered as a simple expedient in most perforations of the thoracic esophagus in view of the very high morbidity and mortality inherent in this condition. It should particularly be applied to those perforations which are referred late. We would not use it in all perforations but we would use it in some patients within the first six or eight hours, particularly in those with a distal obstruction. I doubt that a mushroom catheter or balloon would heal such a perforation.