ESOPHAGECTOMY FOR UNSUCCESSFUL ANTIREFLUX OPERATIONS

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Background: Primary antireflux surgery provides excellent symptom relief in most patients. Unfortunately, the results of redo surgery are less predictable. In these patients, esophageal injury from long-standing reflux of gastric contents and operative trauma from previous failed antireflux procedures results in progressive deterioration in esophageal propulsion, poor clearance of reflux episodes, mucosal damage, and, in some cases, stricture formation. For the past 16 years, we have selectively used esophageal resection and replacement instead of another reoperation in these challenging patients. **Methods:** Seventeen patients with end-stage esophageal body dysfunction and one or more previously unsuccessful antireflux procedures underwent esophagectomy and reconstruction by colon interposition in 15 patients and jejunum interposition in 2 patients. The indications for esophagectomy rather than a redo antireflux procedure were a global loss of effective esophageal motility in 13 and a nondilatable stricture in four. Their outcome was compared with that of 32 patients with adequate motility and 18 with a similar global loss of motility who had a redo antireflux procedure. Perioperative complications after esophagectomy were recorded, and long-term outcome was assessed by means of a standardized questionnaire at a median of 7 years after the operation. **Results:** Patients with profound esophageal body dysfunction who underwent esophageal resection had outcomes similar to those with normal motility who underwent a redo antireflux procedure. Those with profound esophageal motility dysfunction who underwent a redo antireflux procedure had a worse outcome than those who underwent resection. Esophageal resection and replacement was performed without mortality or graft failure. All patients who underwent resection stated that their preoperative symptoms were relieved completely ($n = 6$) or improved ($n = 10$). Thirteen patients (81%) were able to eat three meals a day, and 12 patients (75%) enjoyed an unrestricted diet. Two thirds of the patients were at or above their ideal body weight, and 88% were fully satisfied with the outcome of the procedure. **Conclusion:** Patients with end-stage esophageal body dysfunction who have had a previous unsuccessful antireflux procedure can be treated by esophageal resection with a high expectation of success. (J Thorac Cardiovasc Surg 1998; 115:296-302)

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Antireflux surgery is a highly effective and durable therapy in more than 90% of patients with primary gastroesophageal reflux disease (GERD).¹⁻³ The advent of laparoscopic fundoplication in 1991⁴⁻⁶ has made surgical therapy of GERD more acceptable. Unfortunately, some antireflux procedures fail, and the successful outcome of a redo operation is less predictable.⁷⁻⁹ In these patients, loss of esophageal function can result from long-standing reflux of gastric contents or from operative trauma after the previous unsuccessful antireflux procedure. This results in poor clearance of reflux episodes, mucosal damage, and occasional stricture formation. In this

situation, a subsequent antireflux procedure may be associated with a high failure rate, and esophageal resection may be the better option.

We reviewed our experience with esophageal resection and reconstruction in patients who had profound esophageal body dysfunction and a history of one or more previous unsuccessful antireflux procedures to assess their long-term outcome and to clarify the indications to proceed with resection as opposed to attempting another repair.

Patients and methods

Between March 1980 and May 1996, 92 patients underwent esophageal resection for benign disease. Of these, 17 had previously undergone one or more failed antireflux procedures and their existing esophageal function had deteriorated to the point where another repair was thought unwise. Patients who underwent esophageal resection for named esophageal motility disorders were excluded from this study. The medical records of these patients were reviewed with respect to age, sex, symptoms, previous operations, operative morbidity and mortality, and length of hospital stay. Their outcome was compared with a group of 50 consecutive patients who underwent redo antireflux surgery after one or more previous antireflux procedures.

Preoperative esophageal body function was assessed by stationary manometry in all patients who had a redo antireflux procedure and in 14 of 17 patients who underwent resection. In the remaining three patients the presence of a tight nondilatable stricture prevented the passage of the motility catheter. Esophageal manometry was performed using a water-perfused catheter system with radially oriented side ports placed 5 cm apart.¹⁰ The most proximal side port was placed 1 cm below the lower border of the upper esophageal sphincter, with the remaining ports trailing at 5 cm intervals. A series of 10 wet swallows was performed, using 5 ml of water, and the tracings obtained were analyzed on a commercially available software system (Polygram, Synectics Medical, Inc., Irving, Tex.). The results were compared with the values obtained in a series of 50 asymptomatic volunteers.¹¹ Swallows were considered to be simultaneous when the velocity between two contraction peaks was 20 cm/sec or faster. Propulsive failure was defined by a reduction in the contraction amplitudes in the distal esophagus (below the 5th percentile of normal) or the presence of 40% or more simultaneous waveforms in the distal two thirds of the esophagus.

All patients underwent upper gastrointestinal endoscopy. Esophageal strictures were identified by the inability to pass a 36F endoscope. Video esophagrams were obtained in the supine and upright positions using liquid barium, barium-impregnated hamburger, and radiopaque pills in all but two patients. The presence of increased esophageal acid exposure was documented by 24-hour pH monitoring.¹²

A detailed symptomatic follow-up questionnaire was completed, focusing on the side effects of the operation, ability to aliment, and patient satisfaction with the proce-

Table I. Antireflux operations before esophageal replacement: types and numbers of procedures performed

Type of repair	Number
Nissen	19
Hill	2
Angelchik	2
Thal	1
Belsey	2
Collis-Belsey	2
Hernia repair	3
TOTAL	31

cedure (see Appendix). Asymptomatic patients were considered to have an excellent outcome. Patients with minor symptoms requiring no therapy were considered to have a good result. If there was an improvement in symptoms, but intermittent therapy was required, the outcome was considered fair. If their symptoms did not improve or worsened, the outcome was considered poor.

For the purposes of comparison of outcome in the respective treatment groups, the proportions having good/excellent outcome were determined, and 95% confidence limits for these proportions were calculated.

Clinical characteristics of patients who had esophageal resection and reconstruction. The study population consisted of 17 patients, 9 men and 8 women, with a median age of 54 years (range 27 to 66 years). Eight patients had undergone a single prior antireflux operation, whereas five had undergone two and four had three or more previous antireflux procedures. The types of prior procedures are shown in Table I. In addition, six patients had previous foregut surgery, including vagotomy and pyloroplasty, and one Billroth II resection.

Dysphagia was the predominant symptom, occurring in 10 patients despite a median of eight (range 1 to 25) attempts at dilatation. Heartburn was the primary symptom in four patients and regurgitation in three. All but one of the patients with heartburn and regurgitation also experienced dysphagia. Symptoms were present for a median of nine years (range 1 to 30 years) before esophagectomy.

All 17 patients showed evidence of organ failure as manifested by a global loss of esophageal propulsion or the presence of a nondilatable stricture. Eleven of the 14 patients in whom motility studies could be performed had contraction amplitudes less than the 5th percentile of normal, greater than 40% simultaneous waveforms, or both. The remaining three patients had moderate degrees of esophageal body dysfunction and had undergone three or more antireflux procedures.

Esophagectomy was accomplished without thoracotomy in nine patients, whereas the presence of dense adhesions related to the previous antireflux operations required the performance of a thoracotomy in eight. Fifteen patients had reconstruction by colonic interposition.¹³ In two patients with unsuitable colon arterial anatomy,¹⁴ a jejunal reconstruction was done. In 10 patients the esophageal replacement was anastomosed to the high posterior gas-

Table II. Symptomatic outcome of patients with normal and abnormal esophageal motility, who underwent a redo antireflux repair, compared with patients who underwent esophageal replacement after previously failed antireflux surgery

	Good/excellent outcome	95% CI (%)
Re-fundoplication		
Normal motility (n = 31)	28 (90%)	74.25-97.96
Abnormal motility (n = 18)	10 (56%)	30.75-78.47
Overall (n = 49)	38 (78%)	63.38-88.23
Esophagectomy (n = 16)	14 (88%)	61.65-98.45

tric wall. After experiencing difficulty with gastric emptying after this type of reconstruction (severe enough to require reoperation in two), a proximal two-thirds gastrectomy was added in the subsequent five patients. Two additional patients had a total gastrectomy performed because of vagal denervation-mediated gastroparesis. The length of hospitalization ranged from 12 to 24 days (median 15 days). Follow-up evaluations were available in 16 of the 17 patients at a median of 7 years.

Clinical characteristics of patients who had a redo antireflux procedure. A comparison group of 50 consecutive patients undergoing antireflux surgery in the setting of one or more prior antireflux repairs was identified. This group consisted of 28 male and 22 female patients, with a median age of 54 years (range 22 to 77 years). Thirty-six patients had undergone a single prior antireflux operation, whereas 11 had undergone two, and 3 had three or more previous antireflux procedures.

Dysphagia was again the predominant symptom, occurring in 24 patients. Heartburn was the primary symptom in 21, and five had regurgitation. Seven patients with heartburn and regurgitation also experienced dysphagia. The redo antireflux procedures performed included a transabdominal Nissen fundoplication in five patients, a transthoracic Nissen in 21, a Belsey fundoplication in 14, and a Collis-Belsey procedure in 10.

Of these 50 patients, 18 had evidence of esophageal body failure manifested by contraction amplitudes less than the 5th percentile of normal, more than 40% simultaneous contractions in the distal esophagus, or both.

Follow-up information was available in 49 of 50 who underwent a redo antireflux procedure at a median of 2 years.

Results

The outcome after redo antireflux procedures depended on esophageal body function in that patients with normal motility had a better outcome than did patients with impaired esophageal motility (Table II).

Patients with profound esophageal body dysfunction who underwent esophageal resection had outcomes similar to patients with normal motility who had a redo antireflux procedure.

Table III. Early and late complications in patients following esophagectomy after failed antireflux surgery

Early complications	Late complications
Leak of cologastric anastomosis	*Duodenogastric reflux and delayed gastric emptying
Bleeding and pneumothorax	Pneumonia 2 mo postoperatively
Pneumonia	*Delayed gastric emptying
Neck wound infection	Jejunostomy tube infection
	Abdominal incision hernia

*Required surgical treatment.

Patients with profound esophageal body dysfunction who underwent a redo antireflux procedure had an outcome that was worse than those who underwent esophageal resection (Table II).

Perioperative complications occurred in four patients (24%) after esophagectomy, all of whom were treated nonoperatively. Esophageal resection and replacement was accomplished without mortality or graft failure. During the follow-up period, five patients had late complications requiring surgical intervention in two (Table III).

Thirteen patients (81%) in the esophagectomy group were able to eat three meals a day, with a capacity of 75% to 100% of normal. Twelve patients were able to tolerate a completely unrestricted diet without dysphagia. The change in body weight over the follow-up period is shown in Fig. 1.

Discussion

The introduction of laparoscopic antireflux surgery^{4,5} has increased the frequency of surgical therapy in the management of GERD. Although highly effective in the primary setting,¹⁵ unfortunately symptomatic failure occurs in some patients, and repeat antireflux surgery is required. Clinical experience has shown that in certain situations a redo fundoplication will be successful, but that in others the esophagus may not be salvageable and replacement may be required. However, objective criteria to guide the surgeon in this difficult decision to replace the esophagus are lacking.

Esophageal body motility is an important parameter in determining the outcome of a primary antireflux procedure.¹⁶ This study shows that this applies to redo antireflux surgery as well. We have shown that patients with normal esophageal motility do well after redo antireflux surgery, whereas those who undergo redo antireflux procedures with poor esophageal propulsion are less likely to experience

Fig. 1. Change in body weight over the study period. Patients who underwent additional total or proximal two third gastrectomy are indicated separately, as well as four patients who were extremely overweight before esophageal resection (1983 Metropolitan Height and Weight Table, Des Moines Register March 2, 1983).

relief of their symptoms. In contrast, patients with similar severe defects in esophageal motility who undergo resection and replacement experience predictable relief.

Consequently, we propose that the specific indications for esophageal replacement in patients with end-stage GERD and previously failed antireflux procedures are the presence of dysphagia and esophageal organ failure defined by manometric criteria or the presence of an undilatable esophageal stricture.

The manometric criteria we now use to identify the presence of propulsive failure include the presence of more than 40% simultaneous waveforms, contraction amplitudes less than the 5th percentile of normal (<25 mm Hg), or both.

The question whether the stomach,^{17, 18} jejunum,¹⁹ or colon²⁰⁻²² is the best organ to replace the esophagus is not yet answered. It is generally accepted that the stomach is the preferred substitute in patients with a limited life expectancy such as those with esophageal carcinoma. However, in patients with a longer life expectancy, complications after a gastric pull-up procedure, such as aspiration, recurrent esophagitis, and development of Barrett's esophagus become evident.²³ Furthermore, the previous attempts at antireflux surgery may preclude the use of the stomach for reconstruction. Consequently, in patients with benign disease requiring esophageal replacement and in whom the esophageal substitute must last for a decade or more, we

prefer to use the colon. In patients with benign disease, reestablishment of gastrointestinal continuity by a properly performed colon interposition has been shown by this study and others to provide excellent long-term function.^{13, 20, 24, 25}

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Discussion

Dr. Mark B. Orringer (*Ann Arbor, Mich.*). Dr. Hagen has presented a very fine paper that attempts to answer an important question: When is esophageal resection rather than a redo repair the better option for the patient with a failed antireflux operation?

The proposed indications for esophageal resection are (1) the presence of dysphagia and a history of two previous antireflux procedures; (2) the presence of an undilatable stricture; and (3) esophageal organ failure defined by manometric criteria, which in this case is 40% or more simultaneous contractions in the distal two thirds of the esophagus and contraction amplitude of less than 25%. I am in total agreement with the first two of these. The 90% success rate of a properly performed initial

antireflux operation falls to 75% with the second and 50% with the third. So after two failed antireflux operations, whether the patient has dysphagia, resection provides a more reliable and consistent long-term result. And an undilatable stricture is clearly best treated by esophageal resection. But the patient who has dysphagia after a prior single antireflux operation is not as easily relegated to esophageal resection, and I am concerned that nearly half of your patients undergoing resection had only a single previous antireflux procedure.

In a number of these patients a careful history reveals that dysphagia, not reflux, was the predominant symptom preoperatively, and the patient has had an inappropriate antireflux operation performed for what is basically neuromotor dysfunction. This scenario is becoming quite common in my referral practice where laparoscopic antireflux surgery performed for increasingly lax indications is providing a steady stream of therapeutic misadventures and iatrogenic assaults on the gastroesophageal junction. Esophageal dysmotility is often the result of functional diseases of the alimentary tract. And the surgical treatment of psychiatric disease is far from gratifying. These patients are never happy whether their esophagus is in or out, and nonoperative chronic dilatation therapy is often the best option here.

All failures of antireflux surgery are not due to recurrent reflux or intrinsic dysmotility. For example, disruption of the crural repair may result in migration of the fundoplication into the chest, loss of the normal vertical esophageal axis, dysmotility, and a complaint of dysphagia without a stricture, but with reduction of the hernia back below the diaphragm and straightening of the esophagus, dysphagia is relieved. Dr. Hagen, would you advise resection here simply because of abnormal esophageal motility according to your criteria? And although you rely heavily on manometric recordings, what has happened to the good old barium swallow? You do not seem to place much importance on this. If the patient with dysphagia after a single antireflux operation has a normal caliber, normal-thickness esophagus with some retained progressive peristalsis, albeit less than 40% of contractions, is it not worth trying one more time to salvage the esophagus? Did most of your patients undergoing resection have dilated anatomically end-stage esophagi, or have you defined "end-stage" purely on the basis of manometric functional criteria?

Finally, in discussing your functional results of esophageal replacement, 88% were fully satisfied. Did none of these patients require anastomotic dilation? Did none experience regurgitation? Did none have significant dumping symptoms?

In our experience, a thick-walled upper alimentary tract organ-like stomach works better long term in the upper alimentary tract than the thin-walled water absorption chamber that colon is, and you do not see redundancy of the stomach in the chest 10 to 15 years later. This is a relative controversy that remains to be resolved.

Dr. Hagen. Thank you, Dr. Orringer, for your comments and questions.

We do not believe that patients with underlying motility disorders went unrecognized in this series as best as one can possibly tell. We specifically excluded those patients

who had evidence of a named esophageal motor disorder on motility testing from this analysis. I recognize that in some cases when there are profound disturbances in esophageal motility, it may be impossible to tell the difference between the two. However, as best as is possible on the basis of the diagnostic tests available, we try to exclude those patients from consideration here.

Your comments about patients who just do not seem to be satisfied no matter what happens I think brings up a very important point. Most of the patients who have failed antireflux procedures in whom we recommend esophagectomy are offered this procedure after careful discussion. We really take a great deal of time to bring them along before the procedure is actually performed, in many cases months or years before they might make the decision to proceed with resection. I would agree completely that it is not something that should be entered into lightly.

Clearly, if you could identify on a preoperative upper gastrointestinal study or on the motility study a specific technical problem that you might be able to correct, it may be worth considering another antireflux operation. However, in the patients studied here that simply was not the case. The study patients had profound esophageal failure, many of them with significant esophagitis and a few nondilatable strictures. Under these circumstances, going ahead with another attempt at repair would be unwise.

I do not know that the question of whether the stomach, colon, or jejunum is the ideal replacement organ can be resolved on the basis of this particular study. This obviously remains a subject of debate. It has been our experience that the colon works extremely well in the long term and has remained our preferred organ of esophageal substitution in patients in whom the life expectancy is long. The other issue to consider with remedial operations is that after two, three, or four prior antireflux operations, the stomach is not always in the best shape to be used as a reconstructive organ.

Dr. Douglas J. Mathisen (*Boston, Mass.*). Could you tell me what the indications were for gastrectomy? I notice that there were seven patients that you indicated had either partial or total gastrectomy. I am not clear on how many had which. And finally, it was implied that if all things are equal, you prefer a long colon interposition as

opposed to a short colon or jejunal interposition. Is that correct, or did I misinterpret your statement about that?

Dr. Hagen. No, that is correct. For esophageal reconstruction in benign diseases, we prefer long-segment colon interposition with the anastomosis performed in the neck. Again, whenever possible, we try and accomplish the esophagectomy transhiatally.

In most of the patients who underwent a partial gastric resection, it was resection of the upper stomach. We have found the functional results after colon interposition seem to be better when the colon is anastomosed to the antrum. When the colon is anastomosed to a denervated fundus, there are often problems with gastric retention. In fact, one of the patients who was reoperated on over the long-term follow-up had just that problem.

Dr. F. Griffith Pearson (*Toronto, Ontario, Canada*). I just wanted to lend support to the opinion expressed by Dr. Orringer: I think it is potentially excessive treatment to recommend esophagectomy and long colon interposition in a patient who fails after one repair and in whom you have the described disorders. Without having reviewed our own experience, I do not believe one should anticipate a 50% failure rate for a second antireflux repair in the face of the motility disorder described here. We use motility in all of our patients. The finding of this type of hypomotility disorder in the distal two thirds of the thoracic esophagus is common in reflux disease, whether they are first-time or second-time operations. Again, although I have not reviewed the material, what you are saying does not jibe with what I think we see. More important, I do not believe that we should anticipate, even in 1997, that most surgeons will do a series of consecutive colon replacements with no mortality and with so little morbidity. One inevitably divides both vagus nerves, creates a gastric motility problem that is going to give symptoms in some patients, and one needs a very long-term follow-up, as Dr. Orringer implies, to judge results after colon replacement. I have lived long enough to have some long-term follow-up and have now replaced a few of the colon interpositions I did 20 and 30 years ago, these patients had an initial satisfactory result for many years.

For appendix see page 302.

Appendix

1. Postop Dilatations: Yes _____ No _____ Times _____
2. Revisional surgery: No _____ Yes _____ Date _____
3. Eating habits: No. meals/day _____
 Meal capacity: Cup _____ Airline meal _____ Steak dinner _____
 Unrestricted diet _____ Restricted diet _____
 Food avoided _____
4. Swallowing ability: Require liquids with meals _____
 Last to finish meal _____ Sensation of holdup _____
 Pain with swallowing _____ Choking with swallowing _____
 Comments _____
 Recovery time _____
5. Side effects of colon interposition
 Nocturnal regurgitation _____
 Gurgling _____ Early satiety _____ Bad breath _____
 Other _____

None	0 None
Minimal	1 Occasional episodes
Moderate	2 Predictable on position or straining
Severe	3 Episodes of pulmonary aspiration manifested by chronic nocturnal cough or recurrent pneumonia
6. Side effects: Gastrointestinal

Diarrhea _____	Dumping _____
Nausea _____	Bloating _____

None	0 None
Minimal	1 Occasional episodes
Moderate	2 Reason for medical visit
Severe	3 Interference with daily activities

Frequency:	0 Never	D #times/day
	C Constant	W #times/week
		M #times/month
7. Did the operation (cure) (improve) (worsen) your previous symptoms?
8. Are you satisfied with the results of surgery _____
9. If you had the decision to make again, would you undergo the same treatment?

10. Comments: _____