Management of Intrathoracic Stomach with Polypropylene Mesh Prosthesis Reinforced Transabdominal Hiatus Hernia Repair

Mark A Carlson, MD, Robert E Condon, MD, MS, FACS, Kirk A Ludwig, MD, and William J Schulte, MD, FACS

Background: Posterior cruroplasty repair of a large paraesophageal hiatus hernia has a higher than desirable rate of recurrence attributable to the inexorable cyclic negative intrathoracic pressure of respiration and positive intraabdominal pressure produced by straining, physical exertion, and coughing. To reduce the risk of recurrence after repair of a large hiatus hernia and intrathoracic stomach, we have used posterior cruroplasty reinforced with an onlay polypropylene mesh prosthesis. This paper reviews the feasibility of this technique.

Study Design: We did a retrospective review of 44 patients with large hiatus hernia and intrathoracic stomach who had posterior cruroplasty and onlay of polypropylene mesh prosthesis applied to the crura and adjacent diaphragm to repair the hiatal defect.

Results: Preoperative symptoms (mean duration, 26 months) included pain (33 patients), vomiting (21), dysphagia (19) and anemia (8). The typical patient (28 men and 16 women, mean age, 60) had two-thirds or more of the stomach above the diaphragm. Organoaxial gastric volvulus and herniated large or small bowel were present in 10 and 9 patients, respectively. A gastrostomy was performed for temporary drainage in 38 patients in addition to the hernia repair; 11 patients underwent a concomitant Nissen fundoplication. Postoperative complications included pleural effusion (four patients), atrial dysrhythmia (three patients), and superficial wound infection (two patients). Mean followup for 43 patients was 52 months. There have been no clinical recurrences.

Conclusions: Mesh prosthesis reinforced hiatus hernia repair is effective, appears to have a low clinical recurrence rate, and should be an option in the treatment of a large hiatus hernia with intrathoracic stomach. (J Am Coll Surg 1998;187:227–230. © 1998 by the American College of Surgeons)

Thirty years ago, high rates of recurrence following Allison and similar hiatal hernia repairs led many physicians to conclude that surgical cure of this variety of hernia was not reliably attainable and that referral of afflicted patients to a surgeon should not be done. More recently published recurrence rates for repair of paraesophageal hernia vary up to 10%,[1-7] but anecdotal reports to the authors suggest that the recurrence rate may be even higher. Postoperative gastric herniation through the hiatus is also a common reason for failure of a primary antireflux operation.[8-12]

A hiatal hernia defect is commonly repaired by anatomic hiatal closure, approximating the crura posterior to the esophagus with heavy nonabsorbable sutures with or without pledgets.[13-15] The constant motion of the diaphragm and the stress of negative intrathoracic and positive intraabdominal pressure, however, puts such a repair at risk of disruption since there is no strong fascia immediately adjacent to the hiatal aperture, and the sutures encompass predominantly the muscle of the crura. We have addressed the problem of postoperative breakdown of simple crural approximation by using a reinforcing polypropylene mesh prosthesis during open paraesophageal

Received January 27, 1998; Revised March 30, 1998; Accepted May 11, 1998.
From the Department of Surgery, Medical College of Wisconsin, Milwaukee, WI. Current addresses: Department of Surgery, University of Texas Southwestern, 5323 Harry Hines Blvd, Dallas, TX 75235 (Carlson); Department of Surgery, Duke University, Durham, NC 27710 (Ludwig).
Correspondence address: Robert E. Condon, MD, Department of Surgery, Medical College of Wisconsin, 9200 West Wisconsin Ave., Milwaukee, WI 53226.

Published by Elsevier Science Inc.

ISSN 1072-7515/98/$19.00
PII S1072-7575(98)00162-8

hernia repair. We review the clinical outcomes and report on the feasibility of this procedure.

METHODS

Records of patients who underwent polypropylene mesh-reinforced hiatal herniorrhaphy at Medical College of Wisconsin affiliated hospitals between December 1976 and September 1991 were reviewed. This operation was the preferred treatment during this period for patients with hiatal hernia and intrathoracic stomach. Preoperative evaluation included an esophagogastroduodenoscopy (EGD), barium upper gastrointestinal radiography (UGI), or both.

The procedure was performed through an upper midline abdominal incision. A first or second generation cephalosporin antibiotic was given 30 minutes before skin incision; some patients also received postoperative doses. Intrathoracic viscera were reduced into the abdomen, and the hernia sac was excised. A 50–60 Fr bougie was positioned in the esophagus, and posterior cruroplasty was performed with interrupted nonabsorbable monofilament sutures with or without pledgets. A sheet of polypropylene mesh (Marlex®; Davol Inc., Cranston, RI) was applied to the underside of the diaphragm and cruroplasty. A 3-cm circle ("keyhole") was cut in the middle of the mesh to accommodate the esophagus. The mesh was anchored to the diaphragm with interrupted nonabsorbable monofilament mattress sutures around the keyhole and at the periphery of the mesh.

A Stamm gastrostomy was done to serve as a temporary gastropexy and for postoperative gastric decompression. Postoperatively, the gastrotomy was clamped and oral liquids were begun, advancing to soft food after passage of flatus or stool. If the patient tolerated regular food with the tube clamped, the gastrostomy tube was removed before discharge or in the outpatient clinic. Followup for this report was performed by patient interview in clinic or by telephone contact with referring physicians and directly with their patients. Followup EGD or UGI was performed if the patient reported any symptoms. Asymptomatic patients were not investigated because insurers, applying Medicare guidelines, usually refuse to cover charges for such studies.

RESULTS

Forty-four patients (28 men and 16 women, mean age 60, range 30–94) underwent operation. There were two emergency operations for obstruction; strangulation was not present in either case. There were no asymptomatic patients. Preoperative symptoms (mean duration, 26 months) included pain (33 patients), vomiting, (21), dysphagia (19), heartburn (13), weight loss (8), and melena (2). Eight patients had a hematocrit $< 37\%$, and five had occult blood present in the stool. Esophagogastroduodenoscopy and upper gastrointestinal radiography were performed in 28 and 37 patients, respectively. Twelve patients had Grade II or worse esophagitis; three of these had an esophageal stricture, and two had Barrett's esophagus. Typically, two-thirds or more of the stomach was in the chest as estimated by UGI. The gastroesophageal junction was located above the diaphragm in 20 patients. Ten patients had organoaxial gastric volvulus; nine also had herniated colon or small bowel, or both.

Concomitant procedures included gastrostomy (36), Nissen fundoplication (11), gastropexy (2), intraoperative esophageal stricture dilation (2), pyloromyotomy (1), and vagotomy and pyloroplasty (1). The average postoperative length of stay was 12 days (median 11 days, range 6–45 days). A death occurred in a 36-year-old diabetic man who had a sudden cardiac arrest 1 day after an uneventful elective operation and could not be resuscitated. Seventeen patients had 21 complications, including pleural effusion (4), atrial dysrhythmia (3), splenic injury (2), wound infection (2), *Clostridium difficile* colitis (2), atelectasis (2), and pericarditis, pneumonia, UTI, wound hematoma, transient heart block, and wound dehiscence (1 each). A nasogastric tube became entangled with the gastrostomy tube in one patient; the problem was corrected before leaving the operating room by reentering the abdomen. There were no septic complications related to the prosthesis.

The mean duration of followup in the 43 surviving patients was 4.3 years (median, 3.5 years, range, 2 months to 15 years). Ten endoscopic and nine barium swallow studies were performed in 16 patients during followup. When evaluated 4 or more years postoperatively, good to excellent results (Visick I-II, nil or minimal symptoms) were obtained in 38 patients. Preoperative symptoms were relieved in 41 patients.

A fair result (Visick III, moderate disability but medically manageable) was obtained in four patients. Two patients had persistent symptoms postoperatively, one complained of heartburn and the other of bloating. During followup one patient developed dysphagia; another complained of "gas and reflux." None of these patients had received a fundoplication.

All four patients were evaluated with EGD and/or UGI because of their symptoms; no recurrence or obstruction was demonstrated.

A Visick IV outcome (severe disability, treatment failure, reoperation), was obtained in a single patient with Barrett's esophagus, stricture, and intrathoracic stomach who underwent intraoperative stricture dilation, fundoplication, and prosthetic hiatus hernia repair and was relieved of all preoperative symptoms. After 29 months of followup, this patient developed an asymptomatic erosion of mesh into the apex of the fundus of the stomach at a site of repeated endoscopic biopsies done by his physician; the patient had no associated symptoms. This patient later developed adenocarcinoma in the esophageal Barrett's mucosa and 41 months postoperatively underwent a transhiatal esophagectomy for this cancer (the only reoperation in this series). Examination of the resected specimen confirmed the presence of Stage I cancer and also revealed mesh in the bed of a chronic benign fundic ulcer. Classification of this patient as Visick IV is because of reoperation necessitated by development of a cancer.

DISCUSSION

Transabdominal paraesophageal hernia repair was performed in 44 patients with cruroplasty and routine use of a polypropylene mesh onlay prosthesis. There were no immediate adverse events related to the implantation of mesh. The postoperative complications which occurred in this series are comparable to those in other reports of paraesophageal hernia repair.[1-7] We have had no clinical recurrences to date. Published experience with polypropylene mesh in either open or laparoscopic hiatal hernia repair is limited to anecdotal accounts.[16-23] It is possible that we may not have been aware of a small asymptomatic recurrence since we obtained followup studies only if the patient was symptomatic. Because all of our patients were symptomatic preoperatively, our emphasis in this review was on detection of clinically symptomatic recurrence.

Performance of an antireflux procedure in conjunction with hiatal hernia repair has been widely used but remains confusing and controversial. Much of the confusion arises because physicians label patients with reflux esophagitis as having a "hiatus hernia." Reflux esophagitis and true hiatus hernia are diagnostically distinct entities with differing treatment imperatives. Reflux esophagitis requires a fundoplication or similar procedure in surgical treatment. A true hiatus hernia on the other hand, with a major part or all of the stomach in the chest, is similar in its treatment requirements to all other hernias through the abdominal parietes; the hernia needs to be reduced and the aperture needs to be surgically closed. We use fundoplication selectively during hiatus hernia repair, as do others.[5,7]

The patient experience reported here was accumulated before the availability of the expanded polytetrafluorethylene (PTFE) sheet prosthetic material that we and others[22,24] now use in repair of a hiatus hernia. Placement of PTFE as an onlay prosthesis covering the complexly curved tissue surfaces surrounding the esophageal hiatus is facilitated by the fact that PTFE is more flexible than polypropylene mesh.

A concern about infection exists whenever a prosthesis is placed. We had two superficial wound infections involving only subcutaneous tissue but did not experience any clinical infection involving the mesh. Intraoperative entry into the lumen of the intestinal tract and the liberal use of gastrostomy in our patients apparently did not predispose to mesh infection. Our experience provides evidence that polypropylene mesh used as an onlay prosthesis during hiatus hernia repair does not result in an inordinate number of mesh-related complications.

In patients with intrathoracic stomach, prosthetic mesh-reinforced hiatus hernia repair is safe and effective, and has a low clinical recurrence rate (none in our patients who have been followed as long as 15 years).

References

1. Ackermann C, Bally H, Rothenbuhler JM, Harder F. Surgery in paraesophageal hiatal hernia: technic and results [German]. Schwiez Med Wochenschr 1989;119:723–725.
2. Allen MS, Trastek VF, Deschamps C, Pairolero PC. Intrathoracic stomach: presentation and results of operation. J Thorac Cardiovasc Surg 1993;105:253–259.
3. Hill LD, Tobias JA. Paraesophageal hernia. Arch Surg 1968;96: 735–744.
4. Menguy R. Surgical management of large paraesophageal hernia with complete intrathoracic stomach. World J Surg 1988;12:415–422.
5. Myers GA, Harms BA, Starling JR. Management of paraesophageal hernia with a selective approach to antireflux surgery. Am J Surg 1995;170:375–380.
6. Wichterman K, Geha AS, Cahow CE, Baue AE. Giant paraesophageal hiatus hernia with intrathoracic stomach and colon: the case for early repair. Surgery 1979;86:497–506.
7. Williamson WA, Ellis FH Jr, Streitz JM Jr, Shahian DM. Paraesophageal hiatal hernia: is an antireflux procedure necessary? Ann Thorac Surg 1993;56:447–452.
8. Ackermann C, Harder F. Reoperation for paraesophageal hiatal hernia following fundus plication [German]. Schwiez Med Wochenschr 1990;120:512–514.
9. Balison JR, Macgregor AMC, Woodward ER. Postoperative diaphragmatic herniation following transthoracic fundoplication. Arch Surg 1973;106:164–166.

10. Stirling MC, Orringer MB. Surgical treatment after the failed antireflux operation. J Thorac Cardiovasc Surg 1986;92:667–672.
11. Watson DI, Jamieson GG, Devitt PG, et al. Paraesophageal hiatus hernia: an important complication of laparoscopic Nissen fundoplication. Br J Surg 1995;82:521–523.
12. Lim JK, Moisidis E, Munro WS, Falk GL. Re-operation for failed anti-reflux surgery. Aust NZ J Surg 1996;66:731–733.
13. Ellis FH Jr, Crozier RE, Shea JA. Paraesophageal hiatus hernia. Arch Surg 1986;121:416–420.
14. Perdikis G, Hinder RA. Paraesophageal Hiatal Hernia. In: Nyhus LM, Condon RE, eds. Hernia (4th ed). Philadelphia: JB Lippincott Company, 1995:543–553.
15. Stein HJ, Feussner J, Siewert JR. Failure of antireflux surgery: causes and management strategies. Am J Surg 1996;171:36–40.
16. Edelman DS. Laparoscopic paraesophageal hernia repair with mesh. Surg Laparosc Endosc 1995;5:32–37.
17. Pitcher DE, Curet MJ, Martin DT, et al. Successful laparoscopic repair of paraesophageal hernia. Arch Surg 1995;130:590–596.
18. Schneider R, Herrington JL Jr, Granda AM. Marlex mesh in repair of a diaphragmatic defect later eroding into the distal esophagus and stomach. Am Surg 1979;45:337–339.
19. Streitz JM Jr, Ellis FH Jr. Iatrogenic paraesophageal hiatus hernia. Ann Thorac Surg 1990;50:446–449.
20. Bowen TE, Zajtchuk R, Albus RA. Diaphragmatic paralysis managed by diaphragmatic replacement. Ann Thorac Surg 1982;33:184–188.
21. Tanaka F, Sawada K, Ishida I, et al. Prosthetic replacement of entire left hemidiaphragm in malignant fibrous histiocytoma of the diaphragm. J Thorac Cardiovasc Surg 1982;83:278–284.
22. Paul MG, DeRosa RP, Petrucci PE, et al. Laparoscopic tension-free repair of large paraesophageal hernias. Surg Endosc 1997;11:303–307.
23. Huntington TR. Laparoscopic mesh repair of the esophageal hiatus. J Am Coll Surg 1997;184:399–400.
24. Willekes CL, Edoga KJ, Frezza EE. Laparoscopic repair of paraesophageal hernia. Ann Surg 1997;225:31–38.