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The Influence of Transabdominal Gastroplasty: Early Outcomes of Hiatal Hernia Repair

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Abstract
Objective The aim of our study was to review our experience with transabdominal gastroplasty to determine the safety and short-term efficacy of the procedure.
Methods Retrospective review of all patients that underwent transabdominal hiatal hernia repair with concurrent gastroplasty for shortened esophagus between October 1999 and May 2004.
Results There were 63 patients, 27 men and 36 women. Median age was 68 years. The hiatal hernia was classified as type-I in 6 patients, type-II in 10, type-III in 43, and type-IV in 4. The operative approach was laparoscopic in 44 patients and laparotomy in 19. A Nissen fundoplication was performed in 62 patients and a Toupet fundoplication in 1. Wedge gastroplasty was performed in 47 patients and modified Collis gastroplasty in 16. Median hospitalization was 3 days (range, 2–10). Intraoperative complications occurred in 11 patients (17%). One laparoscopic approach (2%) was converted to laparotomy. Postoperative complications occurred in 12 patients (19%), there were no operative deaths. Median follow-up was 12 months (range, 0 to 64). One patient (2%) was found to have a recurrent hiatal hernia diagnosed 14 months, postoperatively. Functional results were excellent in 41 (68%), good in 6 (10%), fair in 12 (20%), and poor in 1 (2%).
Conclusion Transabdominal gastroplasty can be performed safely, with good functional results and a low incidence of recurrent herniation during the short-term follow-up period.

Keywords Short · Esophagus · Fundoplication · Gastroplasty · Lengthening

Introduction

A shortened esophagus is thought to contribute to the high rate of recurrence after transabdominal repair of large hiatal hernias.[1–4] We have previously reported a recurrence rate of 15% after laparoscopic repair of large hiatal hernias and others have noted similar results.[2,5–9] Achieving an adequate length of intra-abdominal esophagus that is tension-free is an important aspect of hiatal hernia repair to prevent recurrence and ensure a proper anti-reflux procedure. However, when a short esophagus is present, transabdominal lengthening is necessary but can be technically challenging.[1] The aim of our study was to review our experience with transabdominal gastroplasty to determine the safety and short-term efficacy of the procedure.

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Materials and Methods

Between October 1999 and May 2004, 526 patients underwent a hiatal hernia repair at the Mayo Clinic in Rochester, MN. Sixty-three (12%) of these underwent transabdominal repair with concurrent gastroplasty for a short esophagus and are the subject of this retrospective review. Medical records were reviewed for information on patient demographics, preoperative symptoms, preoperative

evaluation, operative procedure, postoperative course, morbidity, postoperative evaluation, and outcome. Hiatal hernias were classified by the surgeon at operation according to the method established by Skinner.[10]

In each patient, the surgeon made the diagnosis of a short esophagus intraoperatively. After esophageal mobilization, if less than 2–3 cm of the esophagus could be brought into the abdominal cavity without tension, patients were determined to have a short esophagus.[1] Early in our experience, we performed 16 (25%) transabdominal modified cut Collis gastroplasties.[1,3,11] A single firing of an EEA 25 stapling device (United States Surgical, Norwalk, CT 06858) is applied 2–5 cm distal to the gastroesophageal junction (GEJ) abutting a 50 French bougie, creating a defect through which an Endo GIA Universal Straight 44-4.8 stapling device (United States Surgical, Norwalk, CT 06858) can then be passed. One to two firings of the Endo GIA stapler oriented toward the angle of His along the bougie are then carried out to complete the gastroplasty (Fig. 1). Later in our experience, 47 (75%) wedge gastroplasties were performed (Fig. 2).[12,13] Three to four firings of the Endo GIA stapling device were used to remove a wedge of gastric fundus (15–20-cc volume) from the greater curvature with a 50 French bougie in the esophagus (Fig. 1). Following each type of gastroplasty, a fundoplication was performed as previously described.[2]

Postoperative functional status was evaluated as previously described by our group.[2] Briefly, excellent functional status indicates the patient was asymptomatic without medication; good indicates symptoms were mild without medication or the patient required one postoperative dilation, fair indicates symptoms were controlled with medication or occasional dilation, and poor indicates symptoms were unimproved, hernia recurred or reoperation was required. Major complications were determined to be those that prolonged hospital stay or required additional intervention. Values are reported as the median and range with percentages given in brackets. The Mayo Clinic Institutional Review Board approved this study, and all patients gave consent for research.

Results

During the study period, 63 patients (36 female, 27 male), with a median age of 68 years (range 24–87), underwent hiatal hernia repair and transabdominal gastroplasty at our institution. Median preoperative body mass index (BMI) was 30 kg/m^2 (range 17–41). Signs or symptoms of hiatal hernia were present in all patients, the most common included heartburn in 45 (71%), dysphagia and chest pain in 25 (40% each), regurgitation in 24 (38%), anemia in 15 (24%), abdominal pain and weight loss in 12 (19% each),

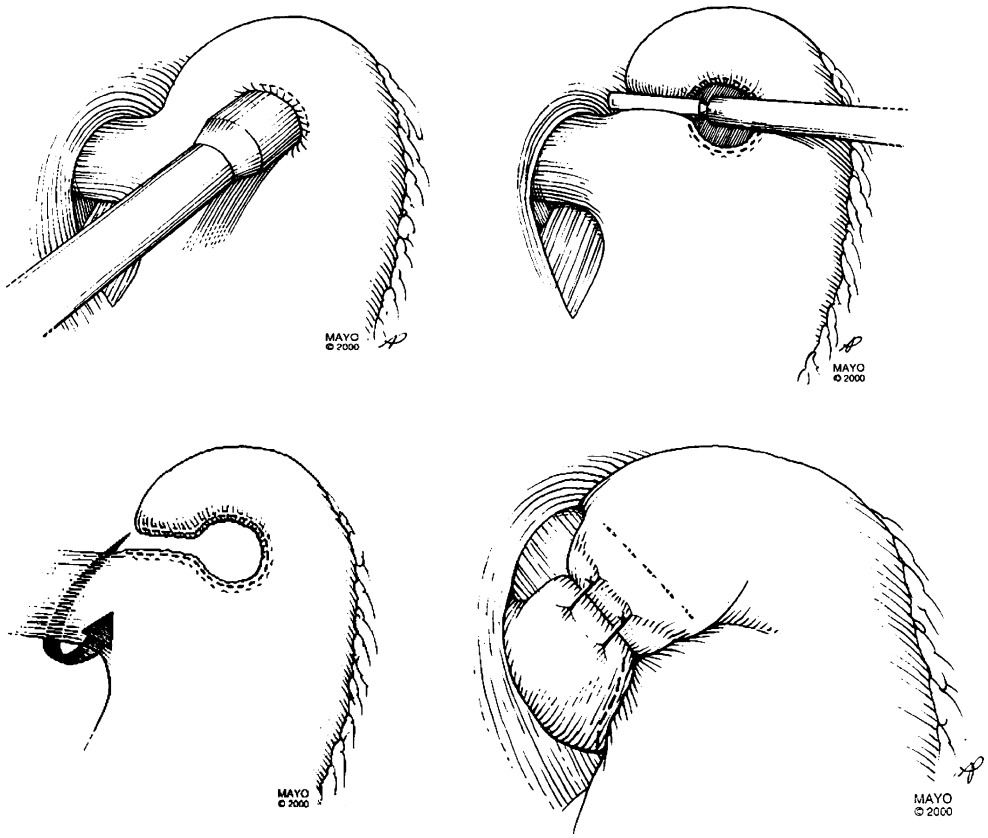

Figure 1 Transabdominal cut Collis gastroplasty utilizing a single firing of an EEA stapler followed by the application of a GIA stapler oriented toward the angle of His as described by Johnson et al.[3]

and aspiration in 6 (10%). Fifty-eight patients (92%) were taking anti-reflux medications at the time of operation. Thirty-nine patients (62%) had undergone prior abdominal operations with 10 of those (16%) having had at least one previously failed fundoplication.

Twenty-four patients (38%) underwent preoperative manometric evaluation. Six patients had normal findings and 18 had abnormal findings including a low lower esophageal sphincter (LES) pressure and abnormal peristalsis. Esophagogastroduodenoscopy (EGD) was performed in 62 patients (98%) and findings included fundic erosions in 11 (18%), esophagitis in 10 (16%), esophageal ulcers in 10 (16%), Barrett's esophagus in 7 (11%), and esophageal stricture 4 (6%). The median hernia size by EGD was 6 cm (range 1–12). Preoperative contrast studies revealed that at least 50% of the stomach (range 20–100%) was intrathoracic in 32 patients (50%). At operation, hiatal hernias were classified as type-I in 6 patients(10%), type-II in 10 (16%), type-III in 43 (68%), and type-IV in 4 (6%).

Operative approach was a laparotomy in 19 patients (30%) and laparoscopy in 44 (70%). One laparoscopic procedure (2%) was converted to laparotomy due to difficulty in safely reducing the stomach. Median esophageal length achieved by gastroplasty was 3.5 cm (range 2.5–5). Median operative time was 190 min (range 89–344). Eight patients (13%) underwent concurrent gastrostomy tube placement. Intraoperative complications occurred in 11 patients (17%) and included pneumothorax in 6, splenic laceration in 2, gastric perforation in 2 and stapled entrapment of a bougie in 1. Postoperative complications occurred in 12 patients (19%) including urinary retention in 5, superficial wound infection in 2, pneumonia in 1, and urosepsis in 1. Two patients were readmitted for dehydration secondary to poor oral intake with one patient ultimately requiring two endoscopic dilatations secondary to stenosis at the gastroplasty site. A third patient was readmitted for a right-sided pleural effusion and subsequently found to have bilateral pulmonary emboli. Overall, 17 patients (27%) experienced at least one complication while 10 (16%) experienced a major complication. There were no leaks or postoperative mortality. Median hospitalization was 3 days (range 2–10).

Follow-up was available in 62 patients (98%) and ranged from 1 to 64 months (median 12 months). Six patients (10%) required postoperative esophageal dilatations including three early (within 4 weeks) and three late (7 to 14 months). One patient who required esophageal dilatation at 7 months postoperatively was subsequently found to have a recurrent hiatal hernia 7 months later. This patient represents the only known recurrence in this series (2%). Fifty-six patients (89%) had a barium swallow performed after an average of 6.5 months (range 1–32) postoperatively. One recurrence was noted as shown above, and the rest showed an intact repair. The patient who developed a recurrence underwent a transthoracic cut Collis–Nissen fundoplication 14 months after the initial laparoscopic Nissen fundoplication and gastroplasty for a 6-cm type-III hiatal hernia. Fourteen months after the second fundoplication, the patient complained of reflux, and a barium swallow again demonstrated a recurrent hernia. He has declined a third repair and is currently being treated with medical therapy.

Sixty-one of 62 patients (98%) reported symptom improvement at last follow-up, and one patient reported that her symptoms were unchanged. Forty-five of 60 patients (75%) with information available on medication use did not require medication for symptom control. Of the 15 patients taking anti-reflux medication, 12 (20%) required daily proton pump inhibitor (PPI) or H_2 blocker therapy while 3 required only occasional antacids. Functional results were available in 60 patients and included excellent results in 42 (70%), good in 6 (10%), fair in 11 (18%), and poor in 1 (2%) Table 1.

Discussion

Achieving a tension-free adequate length of intra-abdominal esophagus is important for successful hiatal hernia repair.[1,14–18] Transabdominal repair of large hiatal hernias has been associated with a higher rate of recurrence which may, in part, be due to a shortened esophagus.[1–7,18] The concept of a short esophagus is not new. In 1957, Collis[16] described his technique for esophageal lengthening. While Collis addressed esophageal shortening, he did not incorporate an anti-reflux procedure. Belsey also realized that achieving an adequate length of intra-abdominal esophagus was an important factor in hiatal hernia repair.[14,17] He advocated a transthoracic approach to hiatal hernia surgery, which allowed for extensive esophageal mobilization resulting in an adequate length of intra-abdominal esophagus without tension on the repair. These two techniques were further expanded upon by Pearson[19,20] with the

Table 1 Functional Results in 60 Patients (Classification Based on the Dominant Symptom/Sign)

Symptoms/Signs	Excellent	Good	Fair	Poor
None	42	–	–	–
Reflux	–	6	5	–
Dysphagia	–		6	–
Bloating	–	–	–	–
Recurrent hernia	–			1
Total	42 (70%)	6 (10%)	11 (18%)	1 (2%)

development and popularization of the Collis–Belsey procedure, for the treatment of patients with large hiatal hernias and a shortened esophagus. It is now widely accepted that the gastroesophageal junction (GEJ) should lie within the abdomen, preferably 2–3 cm below the diaphragm without tension, to achieve the lowest recurrence rate and best results in terms of relief of gastroesophageal reflux.[1,21,22]

Laparoscopic surgery has added yet another challenge to the repair of large hiatal hernias and shortened esophagus.[1] While the laparoscopic technique results in decreased postoperative pain and earlier recovery, this approach has been associated with a higher rate of recurrence after large hiatal hernia repair.[2,5–7,9,23] In the circumstance where the surgeon is unable to achieve 2–3 cm of tension-free intra-abdominal esophagus, most authors would advocate further transhiatal dissection.[1,8,21,24–26] When these maneuvers fail to provide an adequate length of intra-abdominal esophagus, a lengthening gastroplasty is indicated.[1] Laparoscopic Collis gastroplasty was first described by Swanstrom et al.[27] in 1996. This technique involved passing a stapler transthoracically through the diaphragmatic hiatus into the abdominal cavity and performing a gastroplasty. Other techniques have subsequently been described that can be performed totally trans-abdominally.[3,12,13] Johnson et al.[3] described the initial application of an EEA stapler next to a bougie placed along the lesser curvature of the stomach followed by one or two firings of a linear stapler oriented towards the angle of His (Fig. 1). Another technique involves removing a "wedge" of fundus (Fig. 2) which effectively lengthens the esophagus.[12,13] All three techniques are then followed by a fundoplication.

Good results have been reported by various authors after laparoscopic, endoscopic, or open gastroplasty for a short esophagus.[1,3,12,13,28] Jobe et al.[28] reported an overall decrease in reflux symptoms in 15 patients (36% reopera-

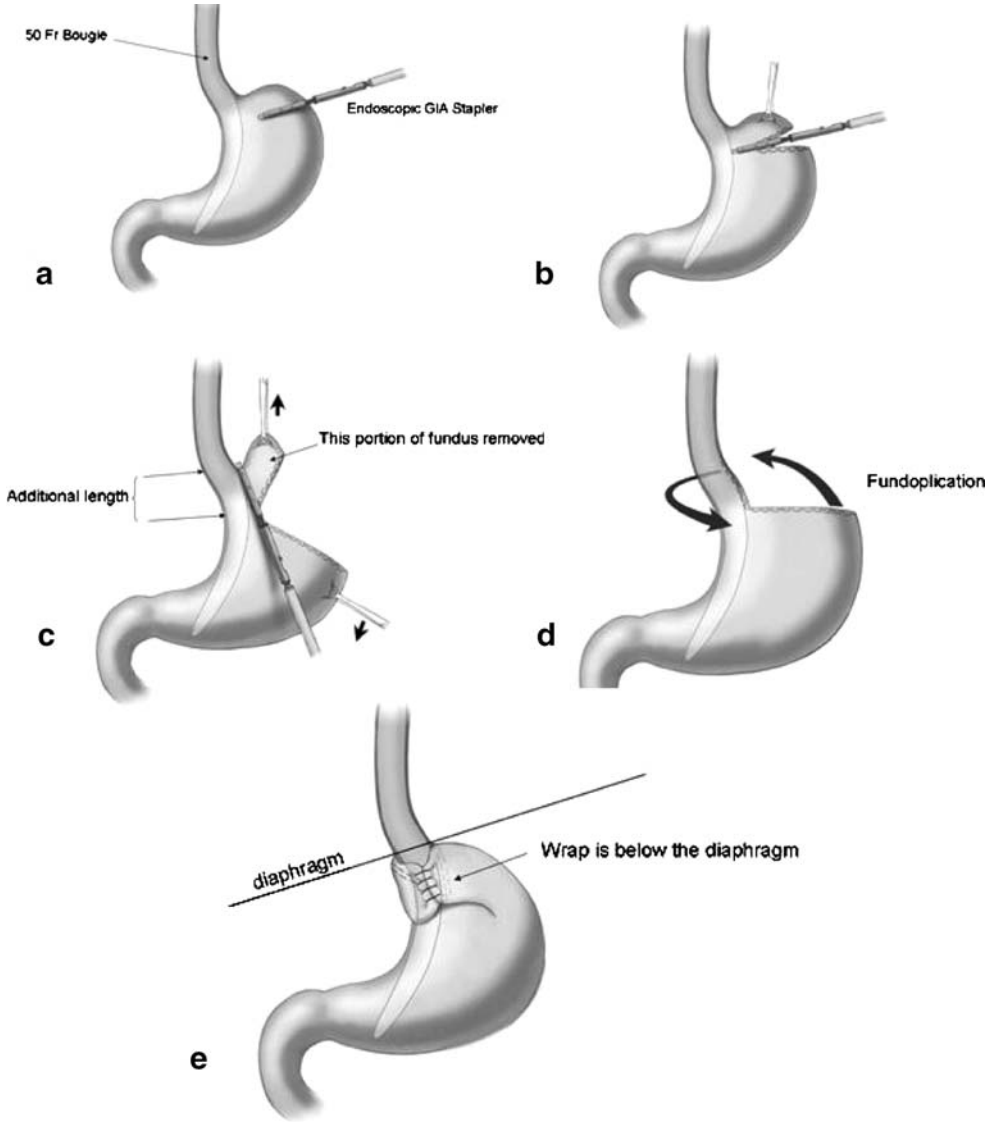

Figure 2 Wedge gastroplasty is performed by removing a wedge of fundus through multiple applications of an endo-GIA stapler.

tions) undergoing a laparoscopic gastroplasty followed by fundoplication. With an average follow-up of 14 months, no recurrences were noted, and the authors concluded that gastroplasty is effective in allowing a tension-free repair in patients with a short esophagus. Lin et al.[12] reported on 68 patients (30% reoperations) undergoing totally transabdominal gastroplasty with a mean follow-up of 30 months. They found the procedure to be safe with a 6% rate of hernia recurrence overall, which is similar to the 2% reported in the current series.

Other authors have advocated alternatives to gastroplasty for obtaining adequate intra-abdominal esophageal length during hiatal hernia repair.[8,21] Madan et al.[21] reported a series of 628 laparoscopic fundoplications without gastroplasties. Their technique involved esophageal mobilization until a 3- to 5-cm length of esophagus was achieved within the abdominal cavity, followed by a fundoplication. In no patient were they unable to achieve adequate intra-abdominal esophageal length, and they concluded that none of the 628 patients had a short esophagus. After 4.3 years of follow-up, the recurrence rate in that series was 2.5%. O'Rourke et al.[8] described applying a mediastinal dissection involving esophageal mobilization of 5 cm or more above the GEJ in 72 patients undergoing hiatal hernia repair. With 10.6 months of follow-up, the recurrence rate in those patients undergoing such a dissection was 10 and 11% in those patients undergoing a less aggressive esophageal mobilization. This led the authors to conclude that extensive mediastinal dissection was an acceptable alternative to gastroplasty resulting in recurrence rates similar to those encountered after a standard dissection. The authors concluded their results made liberal application of a Collis gastroplasty unwarranted.

One concern about increased use of gastroplasties during hiatal hernia repair has been evidence of significant acid production in the neoesophagus.[12,28] Jobe et al.[28] found that 14% of patients had heartburn postoperatively while 36% had persistent esophagitis on EGD. Forty-seven percent of patients had abnormal DeMeester scores during follow-up, and 100% had acid-secreting cells in the neoesophagus. The authors, therefore, recommended that post-gastroplasty patients be maintained on acid-suppression therapy indefinitely. Lin et al.[12] also noted a high rate of patients having abnormal 24-h pH evaluations or esophagitis on EGD postoperatively (80% of those tested). These findings prompted the authors to caution against the liberal use of gastroplasty procedures during hiatal hernia repair, despite the low rate of anatomic recurrence. This contrasts with our findings. Twenty-five percent of our patients require medication for reflux symptoms postoperatively.

In this study, we have shown that transabdominal gastroplasty can be performed safely with good short-term results and a low rate of recurrence. In our study, 12 patients (19%) had either a fair or poor functional outcome. Only one of these patients developed a recurrence. The remaining 11 patients all required daily acid suppression therapy consisting mostly of proton pump inhibitors (PPI). The majority of these patients were otherwise very satisfied with the results of their repair and most importantly, free from their preoperative symptoms.

Conclusion

In summary, transabdominal gastroplasty can be performed safely with a low incidence of significant morbidity. Although only short-term follow-up has as yet been achieved, gastroplasty appears to be associated with a low recurrence rate following transabdominal hiatal hernia repair in patients with a short esophagus. Functional results were satisfactory in the majority of patients. Long-term data on symptoms, recurrence rates, and the effects of acid production in the neoesophagus are needed.

References

1. Horvath KD, Swanstrom LL, Jobe BA. The short esophagus: Pathophysiology, incidence, presentation, and treatment in the era of laparoscopic antireflux surgery. Ann Surg 2000;232:630–640.
2. Dahlberg PS, Deschamps C, Miller DL, Allen MS, Nichols FC, Pairolero PC. Laparoscopic repair of large paraesophageal hiatal hernia. Ann Thorac Surg 2001;72:1125–1129.
3. Johnson AB, Oddsdottir M, Hunter JG. Laparoscopic Collis gastroplasty and Nissen fundoplication: A new technique for the management of esophageal foreshortening. Surg Endosc 1998;12:1055–1060.
4. Yau P, Watson DI, Jamieson GG, Myers J. The influence of esophageal length on outcomes after laparoscopic fundoplication. J Am Coll Surg 2000;191:360–365.
5. Perdikis G, Hinder RA, Filipi CJ, Walenz T, McBride PJ, Smith SL. et al. Laparoscopic paraesophageal hernia repair. Arch Surg 1997;132:586–590.
6. Hashemi M, Peters JH, DeMeester TR, Huprich JE, Quek M, Hagen JA, et al. Laparoscopic repair of large type III hiatal hernia: Objective followup reveals high recurrence rate. J Am Coll Surg 2000;190:553–561.
7. Mattar SG, Bowers SP, Galloway KD, Hunter JG, Smith CD. Long-term outcome of laparoscopic repair of paraesophageal hernia. Surg Endosc 2002;16:745–749.
8. O'Rourke RW, Khafanchee YS, Urbach DR, Lee NN., Lockhart B, Hansen PD, et al. Extended transmediastinal dissection: An alternative to gastroplasty for short esophagus. Arch Surg 2003;138:735–740.
9. Leeder PC, Smith G, Dehn TCB. Laparoscopic management of large paraesophageal hiatal hernia. Surg Endosc 2003;17:1372–1375.
10. Skinner DB. Esophageal hiatal hernia. The condition: Clinical manifestations and diagnosis. In DC Sabiston Jr., FC Spencer (Eds.), Surgery of the chest (6th ed., pp. 1013–1025). Philadelphia: WB Saunders, 1995.
11. Luketich JD, Grondin SC, Pearson FG. Minimally invasive approaches to acquired shortening of the esophagus: Laparoscopic

Collis–Nissen gastroplasty. Semin Thorac Cardiovasc Surg 2000; 12:173–178.
12. Lin E, Swafford V, Chadalavada R, Ramshaw BJ, Smith CD. Disparity between symptomatic and physiologic outcomes following esophageal lengthening procedures for antireflux surgery. J Gastrointest Surg 2004;8:31–39.
13. Terry ML, Vernon A, Hunter JG. Stapled-wedge Collis gastroplasty for the shortened esophagus. Am J Surg 2004;188:195–199.
14. Stylopoulos N, Rattner DW. The history of hiatal hernia surgery: from Bowditch to laparoscopy. Ann Surg 2005;241:185–193.
15. Orringer MB, Sloan H. An improved technique for the combined Collis–Belsey approach to dilatable esophageal strictures. J Thorac Cardiovasc Surg 1974;68:298–302.
16. Collis JL. An operation for hiatus hernia with short esophagus. J Thorac Surg 1957;34:768–788.
17. Skinner DB, Belsey RH. Surgical management of esophageal reflux and hiatus hernia. J Thorac Cardiovasc Surg 1967;53:33–54.
18. Hunter JG, Smith CD, Branum GD, Waring JP, Trus TL, Cornwell M, et al. Laparoscopic fundoplication failures: Patterns of failure and response to fundoplication revision. Ann Surg 1999;230:595–606.
19. Pearson FG, Henderson RD. Long-term follow-up of peptic strictures managed by dilation modified Collis gastroplasty, and Belsey hiatus hernia repair. Surgery 1976;80:396–404.
20. Pearson FG, Langer B, Henderson RD. Gastroplasty and Belsey hiatus hernia repair. J Thorac Cardiovasc Surg 1971;61:50–63.
21. Madan AK, Frantzides CT, Patsavas KL. The myth of the short esophagus. Surg Endosc 2004;18:31–34.
22. Urbach DR, Khajanchee YS, Glasgow RE, Hansen PD, Swanstrom LL. Preoperative determinants of an esophageal lengthening procedure in laparoscopic antireflux surgery. Surg Endosc 2001; 15:1408–1412.
23. Wiechmann RJ, Ferguson MK, Naunheim KS, McKesey P, Hazelrigg SJ, Santucci TS, et al. Laparoscopic management of giant paraesophageal herniation. Ann Thorac Surg 2001;71:1080–1086.
24. Gantert WA, Patti MG, Arcerito M, Feo C, Stewart L, DePinto M, et al. Laparoscopic repair of paraesophageal hiatal hernias. J Am Coll Surg 1998;186:428–433.
25. Awad ZT, Mittal SK, Roth TA, Anderson PI, Wilfley WA, Filipi CJ. Esophageal shortening during the era of laparoscopic surgery. World J Surg 2001;25:558–561.
26. Low DE. The short esophagus—Recognition and management. J Gastrointest Surg 2001;5:458–461
27. Swanstrom LL, Marcus DR, Galloway GQ. Laparoscopic Collis gastroplasty is the treatment of choice for the shortened esophagus. Am J Surg 1996;171:477–481.
28. Jobe BA, Horvath KD, Swanstrom LL. Postoperative function following laparoscopic Collis gastroplasty for shortened esophagus. Arch Surg 1998;133:867–874.