

Laparoscopic Reoperative Antireflux Surgery Is More Cost-Effective than Open Approach



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BACKGROUND: We previously reported on the outcomes of laparoscopic and open reoperative antireflux surgery. The aim of this study was to compare the costs of these procedures.

STUDY DESIGN: We performed a retrospective review. Financial and procedure coding data were obtained using a cost accounting system. There were 49 procedures in 46 patients (36 female and 10 male). There were 38 laparoscopic (including 4 conversions) and 11 open procedures (7 transabdominal repairs and 4 gastric-preserving Roux-en-Y esophagojejunostomy). Values are median and interquartile range (IQR) and mean costs.

RESULTS: Median age was 54 years (IQR 49 to 67 years) for the laparoscopic group vs 56 years (IQR 50 to 65 years) for the open group ($p = 0.675$). Mean direct costs per case for the laparoscopic group vs open group were \$12,655 vs \$24,636 ($p < 0.002$); operating room costs: \$3,788 vs \$5,547 ($p = 0.011$); hospital room costs: \$1,948 vs \$6,438 ($p < 0.005$); and supply costs: \$4,386 vs \$5,386 ($p = 0.077$). Median duration of the operation for the laparoscopic group was 185 minutes (IQR 147 to 254 minutes) vs 308 minutes (IQR 259 to 416 minutes) for the open group ($p < 0.002$). Median length of stay for the laparoscopic group was 3 days (IQR 2 to 4 days) vs 9 days (IQR 8 to 14 days) for the open group ($p < 0.001$). There was no 30-day or in-hospital mortality. Excluding the 4 Roux-en-Y procedures, direct costs for the laparoscopic group ($n = 38$) were \$12,655 vs \$23,678 for the transabdominal group ($n = 7$) ($p = 0.035$); duration of operation: 185 minutes (IQR 147 to 254 minutes) vs 292 minutes (IQR 218 to 309 minutes) ($p = 0.003$); and length of stay: 3 days (IQR 2 to 4 days) vs 9 days (IQR 7 to 15 days) ($p = 0.017$). There were 3 recurrences in the laparoscopic group. Two were repaired laparoscopically and 1 required a gastric-preserving Roux-en-Y esophagojejunostomy because the patient had undergone 2 earlier failed repairs. Including the cumulative costs of 3 recurrent hiatal hernia repairs, the driving force to reduce costs remained length of stay, manifested by the costs of the hospital rooms.

CONCLUSIONS: Laparoscopic reoperative antireflux surgery is more cost-effective than open repair. The laparoscopic approach, when feasible, should be considered the surgical option for treatment of recurrent hiatal hernia in specialized esophageal centers with highly experienced surgical teams. (*J Am Coll Surg* 2017;225:235–242. © 2017 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

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The success and clinical advantages of laparoscopic antireflux surgery and hiatal hernia repair in specialized esophageal centers are well reported¹⁻³ and the rate of recurrent hiatal hernia requiring reoperation is in the range of 2.8% to 8.5%.³⁻⁵

As a result of the complexity of reoperative antireflux surgery, the majority of reoperative procedures are performed via an open approach. In a systematic review of reoperative antireflux procedures, only 36.3% were performed laparoscopically.⁶

We previously reported the outcomes of laparoscopic and open reoperative antireflux surgery in a specialized esophageal center. The results of our study showed that

the laparoscopic approach is safe and can be achieved with shorter length of operation, fewer transfusions, fewer pleural effusions requiring drainage, shorter length of stay (LOS), and with excellent patient satisfaction.⁷ The aim of this study was to compare the costs of reoperative laparoscopic and open antireflux surgery.

METHODS

We retrospectively reviewed the costs of reoperative laparoscopic and open antireflux surgery at the McGovern Medical School at University of Texas Health Science Center at Houston and the Esophageal Disease Center at Memorial Hermann Southeast Hospital in Houston, TX, from September 2, 2010 to October 26, 2015. The study was approved by the IRBs of both institutions. All procedures were performed by a single surgeon with the same anesthesia team and operating room staff. Postoperative care was provided by a trained team of thoracic nurses.

The preoperative evaluation and operative techniques were reported previously.⁷ Financial and procedure coding data were obtained using a cost accounting system by Allscripts Health Solutions, Inc (version 7.2.93.10341). Estimated cost was calculated as a function of patients' billed charges, such as laboratory tests, radiology procedures, supplies, operating room time, and room charges.

Cost for each patient charge (charge description master, which is a unique number assigned to every supply item, test, or procedure) is derived by engineered standard or relative value units that are updated yearly during the budgeting cycle. Relative value units are a way to allocate direct costs, such as direct labor costs (personnel who provide hands on care) and the cost of materials (actual purchase price from vendors). Indirect costs, such as capital expense (brick and mortar, equipment) and indirect labor (hospital leadership and administration) are then allocated to each charge description master using relative value units. Each month the relative value units are used to calculate the cost of a charge description master based on expenses incurred year to date.

To assess the cumulative costs of the recurrent hiatal hernia in the laparoscopic group, the costs of recurrences were added to the costs of the initial 36 laparoscopic procedures, and the cumulative cost was then divided by 36 patients in the laparoscopic group. The cumulative cost was then compared with the costs of patients who had open procedures and then compared with costs of patients who had transabdominal procedures only (excluding the Roux-en-Y procedures).

Statistical analysis

Minitab statistical software (version 16.1.0.0) was used for statistical analysis. Significance was considered at $p < 0.05$. Operating room statistics were captured using SurgiNet software (Cerner Corp).

RESULTS

From September 2, 2010 to October 26, 2015, there were 49 reoperative antireflux procedures in 46 patients (36 female and 10 male). One patient who underwent reoperative transabdominal repair in another hospital was excluded for the homogeneity of cost assessment in the same institution. Values are presented as median and interquartile range (IQR) and mean costs. Failed procedures included 39 Nissen, 6 Toupet, 2 Dor, and 2 Hill funduplications. In all, 41 procedures were performed laparoscopically and 8 were performed open.

Of the 41 failed laparoscopic antireflux procedures, 3 had more than 1 earlier failed laparoscopic hernia repair. Of the 8 failed open antireflux procedures, 4 had 1 earlier failed transabdominal antireflux surgery, 2 had 2 failed earlier antireflux procedures, and 2 had 3 failed earlier antireflux procedures. One had Collis gastroplasty performed at another facility. Absorbable mesh was used in 13 of 49 procedures. Nine of 46 patients had their initial hernia repair at our institution and all had undergone laparoscopic repair in the first antireflux procedure. Six of 9 had crural closure reinforcement with mesh. Three of 9 had primary crural closure.

The reoperative procedures performed in our center included 38 laparoscopic procedures in 36 patients: 3 of whom required additional reoperative procedures for symptomatic recurrent hiatal hernia, 2 were performed laparoscopically, and 1 required a gastric-preserving Roux-en-Y esophagojejunostomy because the patient had undergone 2 earlier failed laparoscopic repairs. This patient presented with forceful retching and vomiting immediately after surgery and presented with recurrent hiatal hernia with the entire stomach herniated into the chest on postoperative day 1. She was repaired laparoscopically with crural closure and reinforcement with absorbable mesh. She then presented with recurrent hiatal hernia 6 months after the last repair and was treated with Roux-en-Y esophagojejunostomy. There were 4 conversions. The details of laparoscopic procedures are shown in [Table 1](#). There were 11 open procedures—7 transabdominal repairs and 4 gastric-preserving Roux-en-Y esophagojejunostomy, as seen in [Table 1](#). Three patients in the laparoscopic group had been repaired previously via open approach, 1 had transthoracic repair and 2 had transabdominal repair. Two of the 3 patients were then repaired laparoscopically with

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