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Evaluation of laparoscopic management of recurrent gastroesophageal reflux disease and hiatal hernia: Long term results and evaluation of changing trends

Samiksha Bansal, Steven S. Rothenberg *

The Rocky Mountain Hospital for Children at Presbyterian/St Luke's, Denver, CO, USA

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ABSTRACT

Introduction: Recurrent gastro-esophageal reflux disease (GERD) following fundoplication remains a common problem. This study evaluates a long-term experience with laparoscopic management of these cases.
Methods: From January 1994 to December 2012, 252 patients with recurrent GERD underwent a laparoscopic redo Nissen (LRN) fundoplication with average age of 6.8 years. Eighty-four had previous open fundoplications and 144 previous LNRs. Thirty-two had more than one previous fundoplication.
Results: All procedures were completed laparoscopically. The average operative time was 82 min. The intra-operative complication rate was 5.1%, the most common being a gastrostomy during the mobilization. The average time to full feeds was 1.4 days, and the average hospital stay was 1.6 days. The post-operative complication rate was 3.6%. The wrap failure rate was 6.2%. The most common cause of wrap failure was H/H, with increasing incidence of slipped wrap during the second half. The highest recurrence rate was in patients receiving their LNR before 4 months of age.
Conclusions: Redo Laparoscopic Nissen fundoplication is safe and effective, with the same benefits as a primary laparoscopic Nissen, with low morbidity and quick recovery. A change in the etiology of recurrence suggests that there is a failure to adequately identify and mobilize the GE junction in laparoscopic cases.

Gastroesophageal reflux disease (GERD) is one of the most common foregut disorder seen in infants and children in United States [1]. Fundoplication is considered in this group of patients for the treatment of GERD refractory to medical therapy or GERD resulting in recurrent aspiration, apnea episodes (sudden infant death syndrome or acute life threatening events), reactive airway disease, neurologic impairment, failure to thrive and esophagitis, and stricture formation [2]. Advances in laparoscopy have significantly changed the practice patterns for the treatment of GERD in pediatric surgery over the last two decades. Prior to 1990's fundoplication was routinely performed through an open approach, requiring a longer hospital stay, and was associated with increased morbidity. Since its introduction in 1991, laparoscopic anti-reflux surgery has rapidly been incorporated into the management algorithm for GERD by both physicians and surgeons [3]. We reported our experience with laparoscopic fundoplication (LF) in 2005 and showed that it not only is safe and effective in the management of GERD in pediatric population with recurrence rate of only 4%, but results in significantly decreased morbidity and hospitalization and results in improved cosmesis and patient satisfaction when compared to traditional open surgery [4]. As a result, LF has become a standard of care for children with GERD requiring operative intervention.

Despite these advances in surgical care, recurrent GERD following fundoplication, whether performed open or laparoscopically, represents a significant clinical problem. It has been reported to occur in 1.4% to 15.4% of children, requiring re-operations, with higher recurrence rates noted for neurologically impaired children [5,6]. The identification of the cause of failure and the management of these patients remain challenging. Reoperations are more difficult due to obscuration of anatomic planes and adhesions from the previous surgery. Although advantages of laparoscopy and its efficacy are well accepted for primary fundoplication, questions and controversies have been raised for its use and safety for the recurrent disease. We hereby present the largest series reported in literature for redo laparoscopic fundoplication and sought to determine the failure rate after first LF performed at a single institution to investigate the mechanisms of failure and to determine the technical feasibility of laparoscopic revision surgery following previous open and laparoscopic antireflux operations in children.

1. Methods

Institutional Review Board approval was obtained prior to initiation of the study. Records of all children younger than nineteen years of age who underwent redo laparoscopic Nissen fundoplication at Rocky Mountain Children Hospital, Denver, Colorado were retrospectively reviewed over a 19 year period between Jan 1994 and Dec 2012. These patients included those with primary Nissen fundoplication, open or

* Corresponding author. The Rocky Mountain Hospital for Children, 2055 High Street, Suite 370, Denver CO 80205, USA. Tel.: +1 303 839 6001; fax: +1 303 839 6033.
E-mail address: steverberg@aol.com (S.S. Rothenberg).

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laparoscopic, performed at our institution and those referred from outside facilities (OSH). Data for both of these groups were analyzed separately. There were no exclusion criteria. Demographics, perioperative, and postoperative information were abstracted from the inpatient and outpatient medical records. Current diagnosis and procedural codes were used for the database search. Data collected included age, gender, weight, symptoms at presentation, past surgical history, operative technique, duration of surgery, intraoperative findings, and complications and outcome variables including time to full feeds, length of stay, and postoperative complications. Variables are expressed as mean ± standard deviation. Statistical analysis was performed using student t test and chi square analysis.

Persistent or recurrent GERD for the purpose of the study was defined as the need for medical treatment of GERD and/or clinical signs of GERD including evidence of aspiration, worsening respiratory status, dysphagia, or persistent emesis after surgery [7]. Nissen fundoplication was performed in all patients with either clinical and/or radiological evidence of recurrent reflux with or without a gastrostomy tube revision.

A total of 2008 laparoscopic fundoplications were performed by or under the direction of the senior author in patients less than 19 years of age during the nineteen year study period between Jan 1994 and December 2012. Of these, we identified 252 children who underwent redo fundoplication (LNR). Patient characteristics are shown in Table 1. There were 131 (52%) boys and 121 (48%) girls. The mean age was 6.8 ± 0.6 years (range 3 months to 19 years) and weight ranged from 4 to 98 kg. Our study population included 16 patients with congenital heart disease and 50 patients who had neurologic impairment and were primarily G tube fed. Indications for re-do operation are either recurrence of GERD and related symptoms or complication related to fundoplication. The most common symptoms were dysphagia (76%), intolerance to feeds or recurrent vomiting (83%), or inability to gain weight (32%). Fundoplication was performed in the remainder of these children (8%) due to increased risk of cardiac and pulmonary events or worsening reactive airway disease, especially in patients with diagnosis of asthma along with GERD. 83 patients had previously undergone open anti-reflux procedures while 169 patients had a primary laparoscopic procedure. Ninety seven of those were performed at our institution, giving a failure rate of 4.6% for primary LF. All patients had a Nissen fundoplication with the exception of 17 patients with Thal and 2 with Toupet fundoplication, all performed at outside referring facilities. All symptomatic patients underwent upper gastrointestinal (GI) study as part of initial workup on presentation while upper endoscopy and 24 h pH probe study was done in 40.6% and 19.4% patients respectively. Upper GI study was positive for presence of recurrent reflux and/or presence of hiatal hernia in 68%. Gastric emptying study was done in 36 patients as was deemed clinically necessary and was positive for delayed gastric emptying in 16 patients. Re-do procedures in our series were not offered to asymptomatic patients.

2. Technique

All patients referred for redo fundoplication since 1994 were approached laparoscopically irrespective of the approach used for prior surgery. The procedures were performed as described in detail previously [8]. The procedure consisted of extensive adhesiolysis, complete mobilization of the stomach, and takedown of the previous fundoplication. If the upper short gastric vessels were not taken in the previous fundoplication, they were divided at this time to allow a tension free wrap. An adequate length of intra-abdominal esophagus was then re-established, and the crura were approximated with interrupted nonabsorbable sutures. In cases with recurrent hiatal hernia, Teflon pledgeted mattress sutures were used for the crural closure. A lateral relaxing incision was made in the diaphragm to take tension off the crural closure in 10 patients. A diaphragmatic patch (Surgisis, Cook Biotech) was then placed over the new defect. In 3 cases, Crurasoft patch (Bard) was placed directly over the crural repair. A full 360° short (~2–3 cm), floppy wrap was then formed around the lower esophagus just above the gastro-esophageal junction at 11 o'clock position with 3 stitches of 2-0 nonabsorbable braided suture. Pyloroplasty was simultaneously performed in 16 patients with evidence of delayed gastric emptying. 3 patients, who have had at least 2 prior fundoplications, required Collis Nissen procedure.

The nasogastric tube was removed at the completion of the procedure prior to extubation, except in cases with intraoperative injury to the esophagus or stomach, where it was left for 48 h postoperatively. In patients with no intra-operative complications, clear liquid diet was started 4 h after surgery and was advanced to soft diet on postoperative day one. Patients were discharged once they met the discharge criteria with adequate oral intake and good pain control, usually on postoperative day 1 or 2. Patients were asked to switch to regular diet after a week of soft diet. Follow-up was a clinical evaluation at 2 weeks, 3 months, and then as needed and varied between 4 months and 10 years (35 ± 30 months).

Table 1
Characteristics and outcome parameters of patients undergoing redo laparoscopic Nissen fundoplication.

Variable	Results
Total No. of patients undergoing redo Nissen	252
Age (years)	6.8 ± 0.6
Male:Female	1.1:1
Weight (kg)	25.5 ± 1.9

3. Results

All procedures were successfully completed laparoscopically. There were no open conversions. Operative times ranged from 25 to 270 min with an average of 82 min with longer operative times for patients with prior open fundoplications. Average operative time for the first 120 cases was 100 min which improved to an average of 64 min for the later 132 cases (Fig. 1). The average time to achieve goal enteral feeds was 1.4 days, and the average length of stay was 1.6 days. Patients who underwent pyloroplasty and those with intraoperative complication were able to tolerate enteral feeds by postoperative day 3 or 4 and were discharged home between days 3 and 5 postoperatively (Table 2).

Hiatal hernia was seen in 118 of 252 patients requiring redo Nissen, with 78 patients in the latter half of the study (Fig. 1). Of these patients, 16 had prior repair of hiatal hernias (9 at OSH and 7 at our institution). All recurrent hernia repairs were done using Teflon pledgets and mattress sutures. Our study population comprised of patients from our institution and those referred from outside institutions. For patients from our institution, hiatal hernia was seen in 8% of the population at the time of primary fundoplication. Of these, 5.7% of the patients were found to have recurrence of hiatal hernia at their first redo fundoplication. We have not had any second recurrences for hiatal hernias, suggesting zero likelihood for a second complication, with the use of pledgeted sutures. Partial or complete dehiscence of wrap was seen equally for both halves of the study and was present in 22% of our population. Over the last 3 year period, an increasing incidence of slipped or malpositioned wraps was noticed and was seen in nine patients compared to presence of hiatal hernia in ten patients over the same time period. We were unable to identify any obvious intraoperative pathology in 5 patients where the initial wrap was done at our hospital. All these patients presented with recurrence of GERD symptoms. Upper GI study suggested the presence of reflux without any obvious wrap migration or disruption. This was followed by upper endoscopy which was reported as