

# Laparoscopic Nissen Fundoplication for Reactive Airway Disease

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**Background:** Surgical management for gastroesophageal reflux disease (GERD)-induced reactive airway disease in children has been shown to be superior to medical therapy. Laparoscopic Nissen fundoplication is a safe and effective procedure in children.

**Methods:** The authors performed a retrospective review of 24 patients who underwent a laparoscopic Nissen fundoplication for documented GERD and reactive airway disease.

**Results:** Persistent cough was the primary symptom in 22 of 24 patients, and all but one had lipid laden macrophages on bronchoscopy. The mean length of hospital stay was 2.7 days. There were no major postoperative complications. Eighteen of 24 patients are symptom free and off all medi-

cations an average of 17 months postoperatively. The average medication burden of the 6 remaining patients was reduced from 6.8 to 2.3 medications.

**Conclusions:** Children with reactive airway disease who do not respond to medical therapy should undergo a workup for GERD. These preliminary results suggest that laparoscopic Nissen fundoplication is a potentially effective treatment for pulmonary manifestations of GERD.

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**INDEX WORDS:** Laparoscopic Nissen fundoplication, gastroesophageal reflux disease, reactive airway disease.

LAPAROSCOPIC NISSEN fundoplication was first reported in the pediatric literature when it was performed on a child for apnea.<sup>1</sup> Subsequently, this procedure has been shown to be a safe and effective method for treating gastroesophageal reflux disease (GERD) in children.<sup>2</sup> A direct relationship exists between GERD and reactive airway disease. Surgical management for GERD-induced reactive airway disease in children has been shown to be superior to medical therapy.<sup>3</sup> One previous report shows the value of a minimally invasive approach to antireflux surgery for reactive airway disease in children.<sup>4</sup> We hypothesize that laparoscopic Nissen fundoplication is a safe and effective therapy for children with GERD-induced reactive airway disease. We performed a retrospective review of a series of pediatric patients with documented GERD and reactive airway disease who underwent a laparoscopic Nissen fundoplication.

## MATERIALS AND METHODS

A retrospective chart review of patients who underwent a laparoscopic Nissen fundoplication for GERD-induced reactive airway disease between October 1998 and December 2000 was performed. Patients were evaluated preoperatively with a combination of upper endoscopy, upper gastrointestinal series, pH probe, and bronchoscopy. All patients were treated medically for both GERD and reactive airway disease. All patients were on multiple drug therapy, including both respiratory and antireflux medications. All patients undergoing surgery had suffered from persistent respiratory symptoms despite medical therapy. All pulmonary medication decisions were reviewed by a single pediatric pulmonologist. Antireflux medications were prescribed by 2 pediatric gastroenterologists. Eleven patients had pre- and postoperative FEV1s measured. An additional 5 patients had only preoperative FEV1s measured.

All patients underwent a laparoscopic Nissen fundoplication performed by one pediatric surgeon. A standard 5-port technique was used using 3- to 5-mm ports. One gastrostomy tube was placed in a neurologically normal girl for additional nutritional support. All patients were started on a clear liquid diet on postoperative day 1. Patients were discharged when taking adequate oral intake.

All statistics were analyzed using 2-tailed, paired, Students' *t* test. This study was approved by the Institutional Review Board at Baystate Medical Center (protocol #02-024).

## RESULTS

Twenty-four patients underwent a laparoscopic Nissen fundoplication for reactive airway disease. The patient ages ranged from 3 to 17 years with a mean of 10.3 years.

Workup for GERD was not consistent among all patients because it was performed by 2 pediatric gastroenterologists. A combination of upper gastrointestinal series, upper endoscopy, and pH probe studies were performed. Twenty-three of the 24 patients underwent a

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**Table 1. Preoperative GERD Workup**

Study	No. of Patients	Positive Results
FFB, lipid-laden macrophages	23	23
Upper gastrointestinal series	17	10
Upper endoscopy	14	10
pH probe	11	8

preoperative bronchoscopy by a single pediatric pulmonologist. All 23 bronchial washings showed lipid-laden macrophages. Results can be seen in Table 1.

The 4 most common presenting symptoms were cough, dyspnea, airway congestion, and weight loss. These symptoms were present in 23 of 24 (96%), 6 of 24 (26%), 5 of 24 (22%), and 5 of 24 (22%) of patients, respectively. The mean duration of symptoms before surgery was 6.5 years. Postoperatively, 22 of 24 patients were free of all symptoms.

All patients were on a range of 4 to 8 medications before surgery, with an average of 5.5 medications. The 2 most common medications prescribed were albuterol (63%) and prednisone (46%). Fifteen patients were on prednisone. The average number of medications taken postoperatively was 0.6. This difference was statistically significant ( $P < .05$ ). Eighteen of 24 patients were off all medications at an average of 17.6 months postoperatively (range, 9 to 20 months, SD = 5.8 months). Of the 6 patients still requiring medication, the average medication burden was reduced from 6.8 to 2.3 medications ( $P < .05$ ). Only one patient remained on prednisone, with a dose reduction from 20 mg/d to 5 mg every other day. One patient had a return of preoperative symptoms despite negative barium swallow results. The second of 2 postoperative pH probe studies showed evidence of continued reflux.

All Nissen funduplications were performed laparoscopically by one surgeon. There were no conversions to an open procedure. The mean operating time was 146 minutes (range, 98 to 216 min  $\pm$  30 min). The mean length of hospital stay was 2.65 days with a range of 2 to 5 days. No intraoperative complications occurred. Postoperatively, 3 patients suffered mild, self-resolving dysphagia.

Pre- and postoperative FEV1s were obtained in 11 patients. These results are displayed in Table 2. The mean pre- and postoperative FEV1s were 90% and 98% of predicted, respectively. The mean change was 7% ( $P = .21$ , not significant).

## DISCUSSION

The relationship between GERD and reactive airway disease has been demonstrated previously.<sup>4,5</sup> Reactive airway disease is a leading cause of morbidity among children, accounting for over 3 million pediatrician visits per year in the United States.<sup>6</sup> Many children suffering

from reactive airway disease or asthmalike symptoms do not receive a workup for GERD. Recently, we have undertaken a more aggressive approach to the evaluation and treatment of those children with reactive airway disease refractory to medical therapy. Most children in this study group had a significant component of GERD contributing to their pulmonary disease.

The prescribing physicians discontinued medications postoperatively only as tolerated by resolution of preoperative symptoms (eg, cough, dyspnea, and airway congestion). The surgeon discontinued antireflux medications, and the pediatric pulmonologist discontinued the respiratory medications. Many of the patients had been treated with as many as 8 medications for respiratory symptoms that had persisted, on average, greater than 6 years. Seventy-five percent of patients were able to discontinue all medications postoperatively. The average change in medications taken pre- and postoperatively was 4.9 ( $P < .05$ ). Although these data are compelling, alterations in the number of medications prescribed is an endpoint that may be biased by the prescribing physician.

Many of the patients in our study group were too young for measurement of FEV1s. Eleven of our patients had both pre- and postoperative FEV1s measured. This small subset of patients showed a trend toward significant improvement of pulmonary function ( $P = .21$ ). The small sample size precluded detection of significant changes in FEV1. Changes in pre- and postoperative FEV1s have been reported previously, but without demonstration of statistical significance.<sup>4</sup> A prospective trial performed with pre- and postoperative FEV1s measured in a larger population may be required for demonstration of statistically significant changes.

Reactive airway disease is prevalent in the pediatric population. The relationship of reactive airway disease to GERD has been shown.<sup>4,5,7</sup> Despite this, we believe GERD is still underappreciated as a significant contributor to respiratory symptoms in the pediatric population.

**Table 2 Pre- and Post-Nissen FEV1s**

Age (yr), Sex	Preoperative FEV1	Postoperative FEV1
8, girl	84	92
10, girl	105	94
12, girl	88	97
15, girl	65	65
15, girl	112	112
17, girl	88	105
9, boy	115	108
12, boy	82	101
12, boy	55	109
13, boy	93	84
15, boy	105	106

NOTE. Eleven patients from the study group that had both pre- and postoperative FEV1s measured. The average change in FEV1 was 7 ( $P = 0.21$ ). (FEV1 reported as percent of predicted).

Children with respiratory symptoms requiring multiple medications, and who are refractory to medical management, should be evaluated for GERD. If GERD contributes to a patient's reactive airway disease, a laparoscopic Nissen fundoplication may improve clinical symptoms

and decrease the number of medications required. Our preliminary observations suggest that GERD contributes to reactive airway disease and that laparoscopic Nissen fundoplication is an effective therapy for the treatment of pulmonary manifestations of reflux disease.

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