



## Laparoscopic antireflux surgery in infants and children

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**To the Editor:** Gastro-oesophageal reflux disease (GORD) is a common problem in infants and children.<sup>1,2</sup> It is a complex problem affecting the health and development of these patients. Non-operative treatment is the first line of treatment in almost all cases; most often symptoms resolve with medical management.

Indications for antireflux surgery in the paediatric population include chronic lung infection, reflux oesophagitis with stricture formations, Barrett's oesophagitis, and failure to thrive. In the case of sudden infant death syndrome (SIDS) associated with other clinical symptoms of GORD, risk of death may be reduced by antireflux surgery.<sup>1</sup> There is also growing evidence that certain chronic ear, nose and throat (ENT) problems are caused by reflux; this has resulted in a large increase in the number of antireflux procedures being performed.<sup>3</sup>

Until recently antireflux surgery in children was performed through a large upper-abdominal incision and involved extensive hospitalisation and recovery periods. Since the introduction of minimally invasive surgery in children it has been shown that these procedures can be performed safely and efficiently, with less postoperative pain, quicker recovery of bowel function and shorter periods of hospitalisation.

The efficacy and complication rate of the laparoscopic repair is at least similar to that of the open procedure.<sup>4,5</sup>

This is a report of a single large series of laparoscopic funduplications in infants and children. The aim of the study was to evaluate the technical results and learning curve associated with this procedure.

### Patients and methods

We reviewed 172 patients who underwent laparoscopic Nissen funduplications for reflux between the years 2000 and 2004. Of these, 104 were boys and 68 girls. Age ranged from 15 days to 12 years, with an average age of 17 months. The patients weighed between 2.9 kg and 44 kg. Eighteen patients had neurological impairment.

Indications for surgery (Table I) included the following.

1. Respiratory compromise in 104 patients. This group included patients with relapsing pneumonia, chronic bronchitis and

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2. Medically refractory reflux with heartburn in 31 patients. This group included mainly older children falling into one of two groups: (i) patients who were still symptomatic despite adequate medical treatment; or (ii) patients who were successfully medically managed, but an informed decision for surgery was taken by the parents.
3. Failure to thrive and vomiting in 22 patients. Our youngest patient was 15 days old and presented with severe emesis, resulting in apnoea, bradycardia and feeding difficulties, despite optimal medical treatment.
4. Chronic ENT pathology in 12 patients. Exposure of the aerodigestive tract to gastric secretions leads to numerous pathological conditions such as otitis media, sinusitis and laryngitis.
5. Oesophageal stricture formation secondary to reflux in 3 patients.

**Table I. Indications for surgery**

	N	(%)
Respiratory compromise	104	(60.5)
Medically refractory reflux and heartburn	31	(18.0)
Failure to thrive and vomiting	22	(12.8)
ENT pathology	12	(7.0)
Stricture formation	3	(1.7)

Preoperative evaluation included 24-hour pH monitoring in 171 patients, upper gastrointestinal imaging in 95 patients, gastric emptying scan in 20 patients and gastroscopies in 55 patients.

Six patients had had previous surgery for congenital abnormalities. These included 4 patients with tracheo-oesophageal fistula and 2 patients with Bochdalek's hernias.

A laparoscopic gastrostomy was also done in 11 of the 18 patients with neurological impairment.

### Surgical technique

The patients were positioned in a supine reverse Trendelenburg position with the lower legs hanging down and the calves protected by a Reston pad. A 5-trocar technique was used, with trocars placed in the umbilicus (camera port), right and left mid-quadrant (working ports), right subcostally in the anterior axillary line (liver retractor) and left subcostally in the anterior axillary line (working port).



A Thompson apparatus was attached to the operating table to hold the liver retractor in position. Using the open (Hasson) method a 5 mm non-disposable port was inserted in the umbilical area. A 5 mm 30° camera was used. Insufflation pressures were kept between 10 mmHg and 12 mmHg. Five and 3 mm Storz instruments (click line instruments) were used.

The first step was to divide the gastrohepatic ligament using a Ligasure instrument (Tyco Valley Lab., Boulder, Colo., USA). The right crus was then identified and cleared. A retro-oesophageal window was developed and care was taken not to injure the posterior vagus nerve. The left crus was then cleared and an adequate length of the intra-abdominal oesophagus was mobilised. The vasa brevia were then bisected using the Ligasure. Two non-absorbable sutures were used to approximate the distal part of the crura. The fundus was pulled through the retro-oesophageal window with a Babcock, and a 2 - 3 cm wrap was formed around an intraoesophageal stent. Two to 3 intracorporeal interrupted non-absorbable sutures were used to form the wrap.

A mixture of 1 mg/kg bupivacaine and 30 mg/kg magnesium was placed below the diaphragm. One mg/kg bupivacaine was injected around the port sites. The ports were removed and the sites were checked for bleeding. The port sites were sutured with 4.0 absorbable synthetic polyester and the skin closed with histo-acryl liquid. A gastric tube was initially inserted to decompress the stomach and was removed at the end of the procedure. The patients were started on clear fluids 6 hours postoperatively.

## Results

All 172 Nissen funduplications were completed successfully. There were no conversions to open surgery. Operative time ranged from 30 minutes to 180 minutes. Average operating time for the first 30 patients was 95 minutes, and for the last 50 patients, 55 minutes.

Patients were discharged routinely on the second postoperative day. Average hospital stay was 2.8 days. Most patients who stayed longer were those with preoperative lung infections secondary to reflux, and also patients who had gastrostomy tubes placed. There were no patients with postoperative ileus.

Complications occurred in 11 patients (6.4%). One patient had a gastric perforation and 1 had prolonged gastric paresis, probably secondary to vagus nerve injury. Four patients presented with postoperative dysphagia. Three of these patients needed a single dilatation and 1 had a laparotomy and redo surgery at another institution. A para-oesophageal hernia occurred in 1 patient, and a port hernia in 1. Both needed surgical correction. Persistent gas bloating occurred in 3 patients. They required hospitalisation and temporary placement of a nasogastric tube. All of these complications

occurred in the first 50 patients, except for 1 patient with dysphagia and 2 patients with persistent gas bloating.

Fifteen patients (8.7%) experienced reflux symptoms again. Seven of these were well controlled with medical treatment. Redo surgery was done in 8 patients. In 7 of these patients, wrap failure was found during redo surgery, and 1 patient had a paraoesophageal hernia. Open surgery was performed in the first 3 cases because we felt lacking in laparoscopic experience at that stage. The last 5 patients were done successfully laparoscopically.

## Discussion

Better and smaller instruments, and improvements in videoscopic technology have made possible the performance of increasingly complex surgical procedures. This has also led to the increased performance of laparoscopic antireflux surgery, even in small neonates. Perhaps the most impressive findings are the lack of respiratory complications and the absence of bowel ileus after laparoscopic surgery.

At least 1 or 2 confirmatory tests should be performed in symptomatic patients<sup>1</sup> before the performance of a fundoplication. A 24-hour pH study was done in all but 1 of our patients. We found oesophagoscopy not very reliable because of the absence of oesophagitis in many patients with pathological reflux on pH monitoring. It also exposes patients unnecessarily to general anaesthesia. Upper gastrointestinal imaging was also done in all infants to rule out all other pathology that may cause vomiting.

Operating time decreased significantly with the learning curve.<sup>2</sup> Currently it does not exceed 60 minutes, even in very small neonates. Using the same laparoscopic assistants also helped to decrease operating time because of their improved skills.

Complications occurred in 11 patients. Almost all of these occurred in the first 50 patients.

Postoperative dysphagia was a problem in a few of our patients. A stent was used to perform the wrap, but protocol for stent size was not available. Under laparoscopic vision we therefore tried different stent sizes until the oesophagus was slightly dilated. The wrap was then performed over this stent. As we gained more experience we developed a protocol for stent size based on the weight of the patient: 1 - 5 kg (size 30F), 6 - 13 kg (32F), 14 - 18 kg (34F), 19 - 25 kg (36F) and 26 - 40 kg (38F).

Oral feeds were started 6 hours after completion of the operations. Patients were kept on a soft diet for 7 - 10 days. Our patients were usually discharged on the second postoperative day (48 hours after surgery). However, some patients were already pain free and on full diet on the first postoperative day, making earlier discharge possible.



This series shows that laparoscopic Nissen funduplications can be done safely and effectively in infants and children.<sup>2</sup> The complication rate was low and recovery was quicker than with the open procedure. Despite favourable outcome, acceptance has been slow. Part of the resistance may be due to the fact that advanced laparoscopic skills are required to perform this procedure.

Antireflux surgery has led and continues to lead to improved quality of life in many carefully selected patients.

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