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Laparoscopic esophagomyotomy for the treatment of achalasia in children

A preliminary report of eight cases

C. Esposito,[1] S. Cucchiara,[2] O. Borrelli,[2] B. Roblot-Maigret,[3] P. Desruelle,[3] Ph. Montupet[3]

[1] Division of Pediatric Surgery, Federico II University Via Pansini 5, 80131 Naples, Italy and Magna Praecia University, Catanzoro, Italy
[2] Departement of Pediatrics, Federico II University Via Pansini 5, 80131 Naples, Italy
[3] Centre Chirurgical, Boulogne Billancourt, Frue du Laos, 75015 Paris, France

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Abstract
Background: Albeit rare in children, achalasia is a disorder with severe symptoms that causes growth impairment. The treatment of choice in children is the esophagomyotomy, although there are variations in the surgical approaches available and differences of opinion regarding the inclusion of an adjunctive antireflux procedure. The recent advent of the laparoscopic approach has had a profound impact on the treatment of achalasia in both adults and children.
Methods: In this report, we describe eight patients with severe achalasia who were treated by laparoscopic Heller's operation associated with a fundoplication according to either Dor's or Toupet's technique. The patients' ages ranged between 2 and 13 years. A five-port technique was used: a 10-mm port placed infraumbilically for the optics and four 5-mm ports. One was placed in the right abdominal quadrant for retraction of the left hepatic lobe, one in the left abdominal quadrant for the first operative instrument, one below the xyphoid appendix for the second operative instrument, and the last one to introduce a 5-mm cannula laterally to the umbilicus to retract the stomach below. A 7–8-cm laparoscopic Heller esophagomyotomy was completed, followed by an anterior Dor fundoplication in six cases and a Toupet in two. The longitudinal division of the anterior esophageal musculature was performed with a scalpel or scissors. The myotomy was made along the stomach, extending for ≥2–3 cm.
Results: Mean operating time was 120 mins. Three complications were recorded. There were two perforations of the gastroesophageal mucosa; the first was sutured in laparoscopy and the second required a second operation. The third complication was a case of dysphagia resolved by dismounting a fundoplication that was too tight. At follow-up, which lasted from 6 months to 5 years, the children were all free of symptoms.
Conclusions: Laparoscopic Heller esophagomyotomy appears to be a complex and difficult operation, but it is as safe and effective as laparotomy in children with achalasia. However, complications can be numerous and severe at the beginning of a surgeon's experience.

Key words: Esophagomyotomy — Achalasia — Children — Laparoscopy — Esophagus

Correspondence to: C. Esposito

Esophageal achalasia is a functional disorder characterized by impaired motility of the distal esophagus and failure of the lower sphincter to relax in response to swallowing. The incidence of this pathology is about five cases per million people per year, and only 5% of these are children [4, 9, 14]. Pharmacological management of achalasia in children is almost always unsuccessful, and pneumatic dilatation is rarely carried out in the pediatric age group. Treatment therefore usually consists of surgery [3, 6, 22].

The advent of minimally invasive techniques has had a profound impact on the treatment of achalasia in adults and, recently, also in children. This report describes our preliminary experience in the laparoscopic management of esophageal achalasia in children. We provide an overview of the possible complications and discuss the difficulties of this technique in pediatric patients.

Patients and methods

Between 1993 and 1998, eight children affected by esophageal achalasia were treated at two different institutions and operated on by the same two surgeons, who employed the same operative procedure. Four patients were girls and four were boys. Their ages ranged from 2 to 13 years (median, 6.3). The clinical symptoms were rumination (four cases), substernal pain (four cases), burning (four cases), nausea (three cases), vomiting (six cases), and dysphagia for >1 year (eight cases).

Preoperative diagnostic investigations included a contrast esophagogram (eight cases), manometry (eight cases), endoscopy (eight cases), and 24-h pH monitoring (four cases). In four children, pharmacological therapy

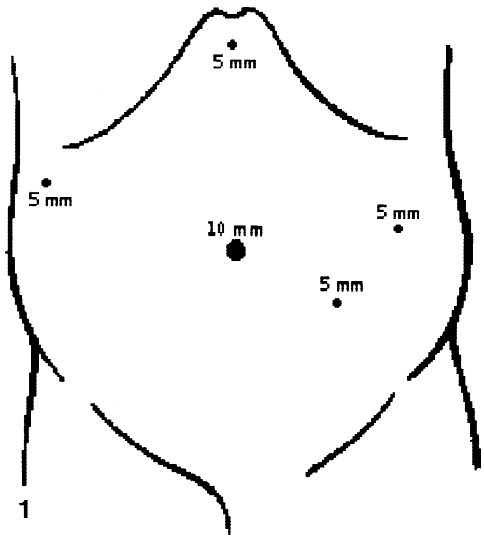


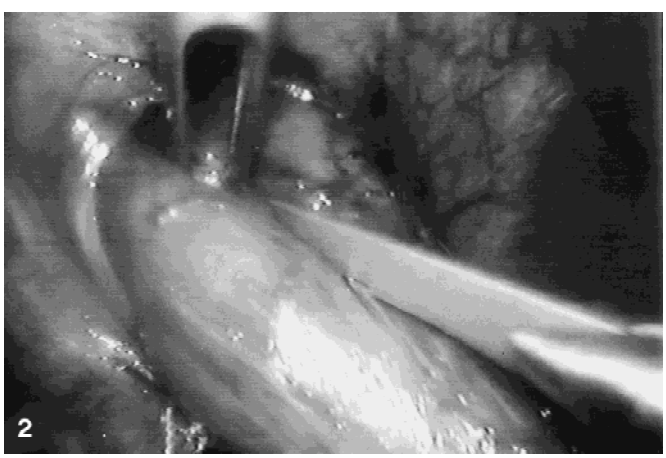
Fig. 1. Positioning of trocars for surgical treatment of esophageal achalasia.

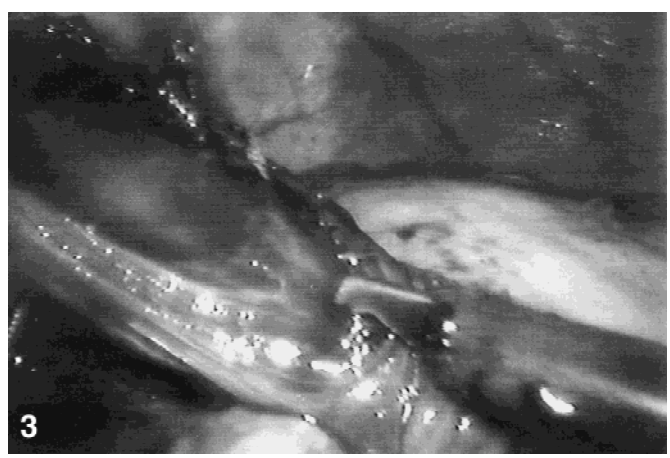
Fig. 2. The myotomy is begun with a scalpel on the anterior part of the esophageal wall.

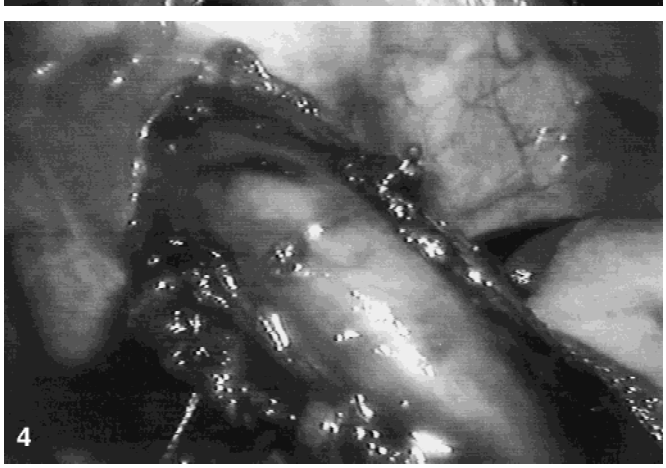
Fig. 3. The myotomy is extended 2 cm below the cardia with a sharp hook.

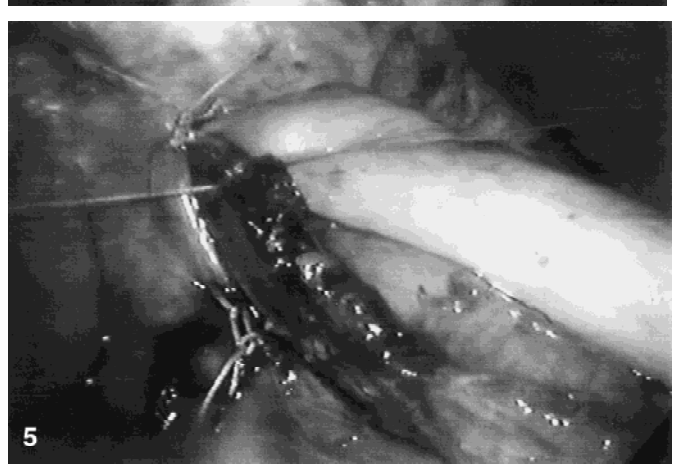
Fig. 4. At the end of the procedure, it is important to verify the completeness of the myotomy and the integrity of the mucosa.

Fig. 5. Following the myotomy, an anterior fundoplication according to the Dor technique is performed.









with nifedipine for 3 weeks had been unsuccessful. For all the children, treatment consisted of an esophagomyotomy according to Heller's procedure via laparoscopy associated with an antireflux procedure. The patients and their parents were informed of the possible need, in case of technical problems, to convert the laparoscopy to a laparotomy. All the operations were performed under general anesthesia with orotracheal intubation. A nasogastric probe was placed before surgery to void the stomach.

The patients were placed supine on the operating table in a reverse Trendelenburg position. The surgeon worked between the legs of the patient, with the first aide on his left. A five-port technique was used, with one 10-mm port placed infraumbilically for the optics and four 5-mm ports. One was placed in the right abdominal quadrant for retraction of the left hepatic lobe, one in the left abdominal quadrant for the first operative instrument, one below the xyphoid appendix for the second operative instrument, and the last one to insert a 5-mm cannula laterally to the umbilicus to retract the stomach below (Fig. 1).

Pneumoperitoneum pressure during the operation was ~10–12 mmHg. The first phases of the operation were the same as those used to treat gastroesophageal reflux. The posterior part of the esophagus was dissected to position a rubber sling around the esophagogastric junction in order to exercise a downward traction on it to allow a better vision of the anterior part of the esophagus. A 7–8-cm laparoscopic Heller esophagomyotomy was thus performed; the longitudinal division of the anterior esophageal musculature was done with a scalpel or scissors (Fig. 2).

The myotomy was always begun on the lower part of the lower esophageal sphincter (LES), then extended to the stomach for ≥2–3 cm (Fig. 3).

Hemostasis of the muscle fibers was achieved via monopolar or bipolar coagulation, or by the placement of clips. The integrity of the mucosa was controlled at the end of the operation by injecting air through an esophageal probe and stretching the two muscular sides of the myotomy laterally (Fig. 4). An anterior 180° hemi-fundoplication according to Dor's technique was used in six cases; a posterior 270° hemi-fundoplication according to Toupet's method was used in two cases (Fig. 5). We always used nonabsorbable sutures, and never used intraoperative manometry or endoscopy in our series.

Results

Mean operating time was 120 mins (range, 90–150). The nasogastric tube was removed on the 1st postoperative day to start early semi-liquid feeding in all but two patients. Hospital stay ranged between 3 and 31 days (median, 4 d).

We had three complications in our series. The first was a perforation of the gastric mucosa at the level of the esophagogastric junction that was detected during the laparoscopy and immediately sutured with detached sutures.

Two other complications occurred in the postoperative period. One child presented with dysphagia 1 year after surgery; it was confirmed with a barium swallow test. The dysphagia was due to the Dor fundoplication, which had become extremely tight. The patient underwent a laparotomy to dismount the Dor fundoplication and create a new fundoplication according to Hill; his hospital stay was 10 days.

The third complication was a tear in the esophageal mucosa at the level of the two inferior points of the Toupet fundoplication. On the 2nd postoperative day, this patient complained of abdominal pain, abdominal wall contraction, fever, and dyspnea. A CT scan showed a collection near the cardia. The patient underwent laparoscopy on the 3rd postoperative day. The perforation was identified and then sutured. The patient was fed parenterally for 3 weeks. He was dismissed after a 1-month hospital stay.

All children were evaluated with a minimum follow-up of 6 months, which included a barium swallow and a manometric exam. At a maximum follow-up of 5 years, the children were all free of symptoms.

Discussion

For the treatment of children with esophageal achalasia, the esophagomyotomy is the technique of choice, since it gives better results than other treatments, relieving symptoms in ~90% of cases [1, 8, 13, 18]. The other therapeutic approaches to treat esophageal achalasia in children—such as pneumatic dilation, which is frequently used in adult patients—do not seem to give as good results in children; however, there is still insufficient experience with pneumatic dilation in the pediatric population [11, 15, 16, 19]. Medical treatment using pharmacological agents such as nifedipine or botulin toxin, often used by pediatric gastroenterologists in the early stages of this disease, does not seem to resolve the problem definitively [9, 14, 22].

If Heller's operation is not associated with an antireflux procedure, 10–20% of these children develop gastroesophageal reflux in the postoperative period [5, 9, 14, 17]. Clinical data on pediatric patients operated for achalasia via laparoscopy are still scanty; however, on the basis of our large experience in the laparoscopic treatment of children with gastroesophageal reflux, our group has also adopted the laparoscopic approach for children affected by esophageal achalasia.

On the basis of our experience, we believe that the laparoscopic treatment of achalasia has several advantages over the open approach. First, the magnified view and improved exposure of the operative field allow a more accurate operation with minimal operative trauma. Other important advantages include the almost total absence of trauma on the abdominal muscle walls, the mini-invasiveness of the laparoscopic dissection of the hiatus, and the absence of postsurgical ileum. These benefits lead to less postoperative discomfort than is experienced with the open approach.

The technical details acquired during our experience indicate that a 7–8-cm myotomy is necessary to relieve the symptoms; for this reason, in our opinion, it is important to place a rubber sling around the junction to allow wider exposure of the anterior part of the esophagus. It is also important to perform the myotomy over the gastroesophageal junction along the stomach for a distance of at $\geq$2–3 cm to avoid any kind of recurrence of dysphagia after surgery. For this reason, a lengthy follow-up period that includes manometric exams and barium swallow tests is fundamental to detect possible long-term complications, as occurred in one of our patients, in whom the dysphagia appeared 1 year after the intervention [2, 7, 20, 21].

The myotomy can be performed with scalpel, scissors, or hook. However, we now prefer to avoid the use of monopolar coagulation near the mucosa, because it can cause necrosis of the mucosa and secondary perforation. The most delicate and dangerous part of the operation is the myotomy at the level of esophagogastric junction, where the muscle fibers are extremely thin. Thus, the risk of damaging the gastric mucosa is high, as was seen in one of our patients. At any rate, with adequate laparoscopic experience, it is quite easy to suture the perforations and complete the intervention via laparoscopy.

As for the other two complications of our series, the too-tight Dor fundoplication was probably due to the fact that we had fixed the anterior gastric valve onto the two diaphragmatic pillars, which should, instead, be avoided since the procedure can cause postsurgical dysphagia. Instead, it is preferable to attach the valve to the two muscular edges of the myotomy. The second complication was a perforation of the mucosa after Toupet's procedure, which probably occurred during the myotomy. Unfortunately, this incident went undetected during the operation due to the small size of the perforation. However, these complications are probably common in both laparotomy and laparoscopic procedures. They are related to the treatment of a rare pathology—esophageal achalasia in children [12, 23]. For this reason, a sound knowledge of the anatomy of the gastroesophageal junction and extreme caution during the dissection and the myotomy are necessary to avoid severe complications. We believe that it is necessary to include an antireflux procedure to avoid gastroesophageal reflux after surgery. The choice of the type of fundoplication to perform depends upon the surgeon's personal preference; most surgeons prefer the Dor procedure [1, 10].

The laparoscopic Heller intervention is a good procedure to adopt for the treatment of children with esophageal

achalasia, and the laparoscopic route can now be considered a logical and modern approach for the management of this pathology. However, we believe that laparoscopic esophagomyotomy is a complex and difficult operation in children. The main limitation to the laparoscopic Heller-Dor procedure is the insufficient experience in children, due to the rarity of this pathology. For this reason, the physician's must be experienced in the surgical treatment of gastroesophageal reflux to perform the esophagomyotomy successfully and reduce the risk of complications for the patient.

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