Robot-assisted Heller’s myotomy for achalasia in children

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ABSTRACT

Background: Achalasia is rare in children. Surgical options include open, laparoscopic and robotic approaches. However, Heller’s myotomy remains the treatment of choice. This report describes our experience with robot-assisted Heller’s myotomy in children and presents a review of the literature.

Methods: Included in this study are children who underwent robot-assisted Heller’s myotomy for esophageal achalasia via the Da Vinci surgical system between 2004 and 2015 at King Saud University Medical City, Riyadh, Saudi Arabia. The medical records of these patients were reviewed for demographic data, presenting symptoms, diagnostic modalities, operative procedures, complications, outcomes and follow-ups.

Results: Six patients were identified. The age of the patients at surgery ranged between 2 and 12 years (mean 7.1 years). The most common presenting symptoms were dysphagia, vomiting and nocturnal cough. Contrast swallow and upper gastrointestinal endoscopy established a diagnosis of esophageal achalasia in all of the patients. Four patients underwent esophageal dilation 2–5 times before the definitive procedure. All patients underwent successful robot-assisted Heller’s myotomy with concomitant partial posterior fundoplication. The postoperative course was uneventful. Five patients had a complete resolution of the symptoms and one patient improved. The follow-up assessments have been consistent and have ranged from 0.5 to 11 years (mean 4.4 years).

Conclusion: Robotic-assisted Heller’s myotomy for esophageal achalasia in children is safe and effective and is a suitable alternative to open and laparoscopic approaches.

KEYWORDS

Robot-assisted; robotics; achalasia; Heller’s myotomy; children

Introduction

Achalasia is a rare esophageal disorder that affects mainly adolescents and adults. It is rarer in children, with an estimated incidence of 0.11 per 100,000 children.[1] Heller’s myotomy remains the surgical treatment of choice for achalasia.[2] Surgical options include open surgery, laparoscopy and recently, a robotic approach.[2–4] Few case reports have been published on robotic-assisted Heller’s myotomy in children.[5–11] The aim of this report is to describe our experience with robotic-assisted Heller’s myotomy in children and to review the literature.

Materials and methods

Between January 2004 and November 2015, the medical charts of all children who underwent robotic-assisted Heller’s myotomy for achalasia at King Saud University Medical City, Riyadh, Saudi Arabia were reviewed. Data collected included age, gender, body weight, clinical presentation, mode of diagnosis, operative details, postoperative analgesic requirement, hospital length of stay, complications, follow-up and outcomes.

A symptomatic score for an assessment of achalasia was used (none, score = 0; dysphagia for solid food, score = 1; dysphagia for soft food, score = 2; or dysphagia for fluids, score = 3). The patients were evaluated preoperatively, at postoperative months 3 and 6, and annually thereafter.

Surgical technique

Under general anesthesia, the patient is placed in a supine position. The DaVinci Si Surgical System (Intuitive Surgical, Sunnyvale, CA) was used.
The surgical console is positioned in the operating room, the robotic arms are positioned over the head of the patient, and the monitor is positioned on the left side of the patient. A pneumoperitoneum is established using a Veress needle introduced through an 8.5-mm umbilical incision. This port is used for the 3D robotic scope. Two 5-mm working ports are introduced in both sides laterally. Of note, these two ports are introduced as laterally and caudally as possible to avoid robot arm collision. A 3-mm accessory port is introduced at the epigastrium for liver retraction. Another 5-mm accessory port is introduced between the umbilical port and the port on the left side.

The procedure starts by dissecting the right and left crura; then, the gastroesophageal junction is anteriorly and posteriorly dissected. Short gastric vessels are divided if needed for fundoplication. Anterior and posterior vagus nerves are identified and preserved. A longitudinal myotomy is performed using an electrosurgery hook starting from the gastroesophageal junction and extending upwards 6–8 cm then downwards for 2–3 cm toward the angle of the stomach. After adequate myotomy, air is introduced to check for mucosal perforation through a nasogastric tube where the tip of the tube is located in the esophagus above the surgical site. The fundus is then moved from behind the esophagus, and Toupet posterior fundoplication is accomplished by suturing the fundus to the edges of the myotomy using non-absorbable 2-0 Ethibond sutures (Johnson & Johnson International, Inc., New Brunswick, NJ).

Postoperatively, patients were moved back to the pediatric surgical ward. Feeding was started 12–24 h postoperatively. Intravenous paracetamol was used for analgesia, and opioid injection was used as needed. A contrast upper gastrointestinal study was not routinely performed postoperatively.

Results

A total of 12 children were diagnosed with achalasia between 1990 and 2016: four patients underwent open Heller’s myotomy, one patient underwent laparoscopic-assisted Heller’s myotomy, one patient waited for surgery and six patients underwent robotic-assisted Heller’s myotomy (the subjects in this study). The patients consisted of two males and four females. The age at diagnosis ranged from 0.5 to 12 years (median 4.5 years), and the age at surgery ranged from 2 to 12 years (median 7 years). Two patients also presented with Allgrove syndrome (Table 1). The most common symptoms were dysphagia, vomiting and nocturnal cough. Other symptoms included bronchial asthma-like symptoms and failure to thrive (Table 2). The diagnosis of achalasia was established via upper gastrointestinal contrast study and upper gastrointestinal endoscopy in all patients. High-resolution manometry is not performed routinely in children in our institution.

Preoperative esophageal dilatation was performed in four patients (66%) between two and five times. The aim of preoperative dilatation was to improve the nutritional status of the patients and to relieve symptoms while waiting for definitive surgery. Both pneumatic and bougienage dilatation were used. No esophageal perforation occurred due to dilatation.

All patients underwent robotic-assisted Heller’s cardiomyotomy with a Toupet anti-reflux procedure (270° partial posterior wrap) using the Da Vinci Si Surgical System (Intuitive Surgical, Sunnyvale, CA). No intra- or postoperative complications and no conversion to laparoscopic or open technique occurred. Operative times ranged from 186 to 250 min (median 204 min). Five patients required oral paracetamol for 48 h for analgesia. Only one patient required opioid for analgesia for 24 h. Postoperative hospital length of stay ranged between 2 and 7 days (median 3.5 days). Pre- and post-operative dysphagia scores were utilized. Five patients (83%) experienced complete symptom relief (dysphagia score: 0), and one patient exhibited improvement (achalasia score: 1). This patient had a preoperative score of three and postoperatively experienced occasional dysphagia to solid food. None of the patients required postoperative esophageal dilatation or reoperation. Follow-ups ranged from 6 to 132 months (median 24 months).

Discussion

Esophageal achalasia is a rare neuromuscular disorder of unknown etiology that is manifested as a failure of the relaxation of the lower esophageal sphincter and
Primary clinical symptoms are dysphagia, vomiting, nocturnal cough and failure to thrive if the disorder is left untreated. [3]

The current treatment goal is symptomatic relief. [4] There are several treatment options including oral medications, botulinum toxin injection to the lower esophageal sphincter, pneumatic or mechanical esophageal dilatation and endoscopic or surgical myotomy. [2–5] Controversy still exists concerning which treatment option is the best due to the rarity of the disease in children, the presence of multiple treatment modalities and a lack of randomized controlled studies in this age group. [12] Despite the lack of a definite conclusion, advances and refinements in laparoscopy in pediatrics, a low rate of complications, a high rate of success and faster recovery have shifted the treatment preference toward laparoscopic Heller’s myotomy. [13] Most studies in children have supported using surgical Heller’s myotomy for long-term outcomes since the introduction of minimal surgical techniques. [5, 14–17]

Recently, endoscopic peroral esophageal myotomy (POEM) has also been described. Inoue H. et al. performed the first POEM in adults in 2008. [18] The first pediatric POEM was reported in 2012 for a 3-year-old girl with achalasia and Down’s syndrome. The child experienced adequate symptom relief when followed for 1 year. [19] Since then, a few small studies of POEM in children have been reported. [20–22] In a comparative study, Caldaro T. et al. compared laparoscopic Heller’s myotomy to POEM in 18 pediatric patients with achalasia. The authors concluded that the follow-up data indicated that laparoscopic Heller’s myotomy and POEM were safe and effective in children. [15] POEM in children is still not popular due to the rarity of achalasia and the need for advanced centers with skilled endoscopic teams to perform the procedure. [15]

Esophageal myotomy can be performed using either an abdominal or a thoracic approach, and the procedure can be performed with open, laparoscopic or robotic-assisted techniques. In a prospective comparison study, laparoscopic Heller’s myotomy compared favorably with open myotomy in terms of excellent dysphagia relief and low-gastroesophageal reflux rate. [23] Until now, laparoscopic Heller’s myotomy has been considered the treatment of choice for achalasia in adults and children with excellent long-term results. [14–17]

Conventional two-dimensional laparoscopic procedures lack the flexibility of instruments and the high-quality three-dimensional imaging that are facilitated by the robot, especially in a narrow operation field with the need for advanced intracorporeal suturing. [2, 5] In addition to these advantages, robotic surgery provides motion scaling with the elimination of hand tremors. Precise high-definition imaging allows the surgeon to see all muscle fibers, which thus decreases the likelihood of mucosal perforation. [5] Both laparoscopic and robotic-assisted esophageal myotomy are comparable in terms of feasibility, safety, and long-term symptomatic relief. [24, 25] However, robotic surgery is superior in terms of mucosal perforation. In a comparative study of 121 myotomies in adults, there were no cases of mucosal perforation in the robotic myotomy group, but mucosal perforation occurred in 16% of patients in the laparoscopic group. [3] Another advantage of a robotic procedure is telesurgery, which can potentially be used in situations or environments in which it is difficult to transport a patient or a surgeon. [8]

In a large retrospective comparative study including 2683 adult patients who underwent open, laparoscopic or robotic Heller’s myotomy, Shaligram et al. found no differences between the laparoscopic and robotic procedures in terms of morbidity, mortality, length of hospital stay or readmission rate. Both laparoscopic and robotic surgeries were superior to open myotomy regarding perioperative outcomes. [24]

The addition of an anti-reflux procedure to Heller’s myotomy is still controversial. [23, 26] Although studies in adult patients support performing an anti-reflux procedure in Heller’s myotomy, it is still unclear whether all children should undergo an anti-reflux procedure to prevent gastroesophageal reflux. [27–29] An anti-reflux procedure significantly reduces the risk of gastroesophageal reflux but increases the risk.

### Table 3. Published cases.

| Publication | Procedures | No. of patients | Conversion | Complications |
|-------------|------------|----------------|------------|---------------|
| Chaer RA et al. (2004) | Heller’s myotomy + Dor fundoplication | 2 | none | none |
| Klein MD et al. (2007) | Heller’s myotomy + Dor fundoplication | 2 | none | none |
| Najmaldin A and Antao B (2007) | Heller’s myotomy + Thal fundoplication | 2 | none | none |
| Meehan JJ and Sandler A (2008) | Heller’s myotomy | 2 | none | none |
| Camps JI (2011) | Heller’s myotomy | 4 | none | none |
| This study (2016) | Heller’s myotomy + partial posterior wrap | 6 | none | none |
| Total | 18 cases | none | none |
of dysphagia, and the debate continues on which symptom is easier to manage the reflux or the dysphasia.[12,26–27] Authors, who believe that the management of dysphagia in children is easier, especially with dilatations, do not support a concomitant anti-reflux procedure. Other authors who believe that there is a significant rate of reflux advocate for fundoplication. [12,26–27] Because dysphagia commonly occurs post-myo-otomy, an algorithm was proposed to address post-Heller’s myotomy dysphagia.[30] Identification of the ideal anti-reflux procedure in children is still controversial, but both Dor and Toupet fundoplication techniques showed similar results.[29]

Few robotic myotomies in pediatric patients have been published in the literature (Table 3).[5–11] The total number of robotic Heller’s myotomy cases, including ours, is 18 cases. Most patients underwent a concomitant anti-reflux procedure. To our knowledge, this study includes the largest patient population that has been reported. In all reported cases, there were no intraoperative complications or conversions to laparoscopy or open surgery.

Conclusion

Robotic-assisted Heller’s myotomy for esophageal achalasia in children is safe and effective and offers a good alternative to open and laparoscopic approaches. In addition, robotic assistance provides excellent visualization, precise dissection and outstanding maneuverability of the instrument, which may reduce operative complications.

Disclosure statement

All authors have no conflicts of interest.

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