Robotic-assisted Heller Myotomy Is a Safe Operation

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ABSTRACT

Background: Surgical myotomy is the best therapeutic option for patients with achalasia. The minimally invasive technique is considered to be the preferred method for many surgeons. Robotic-assisted laparoscopic myotomy has several advantages over conventional laparoscopic surgery. These benefits include more accurate incisions that may result in a lower rate of intra-operative complications.

Objective: To describe our technique of performing robotic-assisted Heller myotomy and to review the initial results of this procedure.

Methods: All patients undergoing robotic-assisted Heller myotomy for achalasia between the years 2012–2018 at Rabin Medical Center were retrospectively reviewed from our institutional prospective database.

Results: Thirty patients underwent robotic-assisted Heller myotomy for achalasia. Mean operative time was 77 minutes (range 47–109 minutes) including docking time of the robotic system. There were no cases of conversion to laparoscopic or open surgery. There were no cases of intra-operative perforation of the mucosa. None of the patients had postoperative morbidity or mortality. Good postoperative results were achieved in 25 patients. Four patients required additional intervention (3 had endoscopic dilatations and 1 with known preoperative endstage achalasia had undergone esophagectomy). One patient was lost to follow-up.

Conclusions: Robotic-assisted Heller myotomy is a safe technique with a low incidence of intra-operative esophageal perforation compared to the laparoscopic approach. We believe that robotic-assisted surgery should be the procedure of choice to treat achalasia.

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KEY WORDS: achalasia, Heller myotomy; robotic-assisted surgery

Achalasia, a Greek term that means *does not relax*, is a disease of unknown cause in which there is failure of lower esophageal sphincter (LES) relaxation and loss of peristalsis in the distal esophagus. Achalasia was first described by Sir Thomas Willis in 1674 [1].

Treatment of Achalasia is aimed to lower the pressure in the LES either mechanically by surgical myotomy or endoscopic balloon dilatation or pharmacologically by oral nitrites, calcium channel blockers or endoscopic injection of Botulinum toxin [2,3]. Surgical myotomy, first described by Heller in 1913, has been found to be superior to endoscopic dilatation in terms of cumulative response rate with significantly less major mucosal tears requiring subsequent intervention [4,5].

Another emerging treatment option for achalasia is peroral endoscopic myotomy (POEM). Werner et al. [6] conducted a randomized controlled study comparing surgical myotomy with POEM, demonstrating that POEM is not inferior to laparoscopic Heller myotomy with Dor's fundoplication. However, gastroesophageal reflux was more common in patients undergoing POEM than the surgically treated group. At 24 months, 44% of the patients in the POEM group and 29% of the surgical group had reflux esophagitis, assessed by endoscopy.

For many years surgical myotomy was performed by an open technique and the debate was whether it should be conducted via a laparotomy or a thoracotomy. The laparoscopic revolution of late 20th century had established laparoscopic myotomy as the standard approach to achalasia. The advantages of the minimally invasive approach over the open technique have made the open technique nearly obsolete. Even patients who underwent multiple abdominal operations can be spared the open technique by using thoracoscopic operation as a substitute to laparoscopy with good results [7,8].

Robotic-assisted laparoscopy has several advantages over conventional laparoscopic surgery: superior visualization including three-dimensional (3D) versus two-dimensional (2D) imaging of the operative field, stabilization of instruments within the surgical field, improved ergonomics for the operating surgeon, and superior articulation [9-12]. Disadvantages include higher costs, longer operations, training requirements, and lack of tactile feedback [13].

The aim of this study was to describe our technique of performing robotic-assisted Heller myotomy and to review the initial results of this procedure.

PATIENTS AND METHODS

Since June 2012, data of all patients undergoing robotic-assisted Heller myotomy for achalasia at Rabin Medical Center have been collected in a prospective database. Data were retrospectively analyzed.

PREOPERATIVE ASSESSMENT

The preoperative assessments included patient medical history, physical examination, esophageal manometry, and upper endoscopy, and in some patients contrast swallow series.

SURGICAL TECHNIQUE

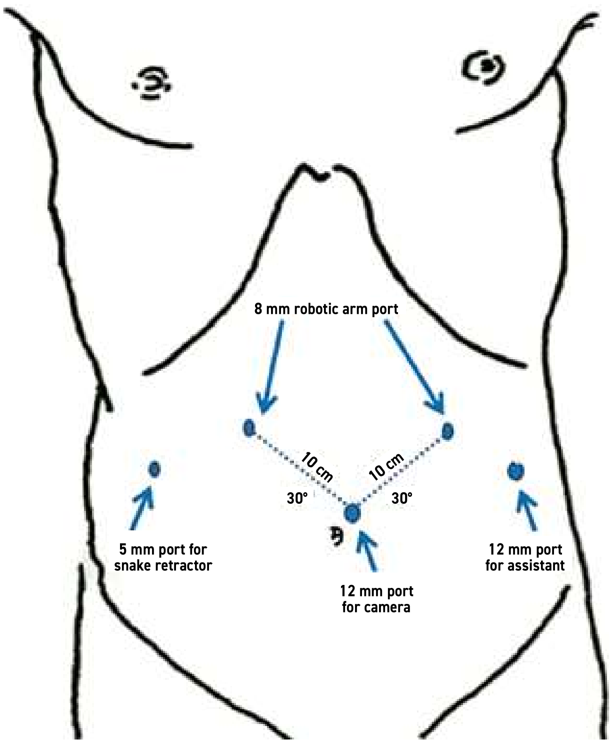
After induction of general anesthesia with endotracheal intubation, the patient is placed supine with legs abducted. Following insufflation of the abdomen with CO2 via a Verres needle to a pressure of 15 mmHg, the patient is positioned in reversed Trendelenburg and a 12 mm camera port is introduced through an incision 2 cm above the umbilicus. Two 8 mm trocars are placed 10 cm diagonally, laterally and slightly upward from the umbilical port [Figure 1]. A laparoscopic articulating liver retractor (snake) is inserted through a 5 mm port placed medial to the right anterior axillary line at the level of the umbilicus. An additional 12 mm port is placed in the left middle abdomen just medial to the anterior axillary line to be used by the assistant. We use the Da Vinci Surgical robotic system® (Intuitive Surgical, Mountain View, CA, USA). The robotic surgical cart is mobilized into position at the left shoulder of the patient. The arms of the robot–one for camera and two working arms–are secured to the three specific ports.

The left robotic arm is used for the grasper/dissector and the right robotic arm is used for the energy source instrument (Harmonic Ace for Da Vinci®).

Surgery begins with dissection and freeing of the lesser curvature and exposing the esophagogastric junction (EGJ) after separating it from its peritoneal attachment. The dissection is carried around the insertion of the esophagus to the stomach.

Dissection of the muscular layer takes place distally 2 cm distal to the EGJ over the anterior aspect of the stomach. The muscle fibers of the stomach are dissected down to the interface between the muscular layer and the mucosa using sharp and blunt dissection and using the energy source sparingly. Since the exact location of the EGJ is not always clear, one may need to extend the dissection distally to achieve release of the muscular layer distal to the EGJ. This results a line of deserozation along the anterior aspect of the stomach thus releasing the muscular layer long enough distally to avoid future recurrence of symptoms. If the release was adequate it will result obvious bulging of the mucosa. The energy source should be used carefully since separation of the muscular layer following the use of the energy source may cause perforation of the mucosa due to coagulation effect and glueing of the muscle fibers to the mucosa. It is sometimes preferable to use blunt dissection without the use of the energy source and accept some bleeding as oppose to a dryer surgical field and higher risk of perforation of the mucosa.

Figure 1. Trocar placement for robot assisted Heller myotomy



The dissection of the muscle fibers is continued proximally in this manner, passing the EGJ into the muscular layer of the esophagus. Using the previous mobilization of the esophagus from its peritoneal attachment, it is possible to proceed proximally at least 5–7 cm along the muscular layer of the esophagus. It is important to ascertain that all muscular fiber bands are completely transected so that no cords are observed over the bulging mucosa over the esophagus and proximal stomach. The bulge of the mucosa should have a smooth fusiform-like shape.

At this point, meticulous homeostasis is achieved and the anterior bulge of the mucosa is covered by the modified Dor's fundoplication using the proximal part of the fundus. The fixation is performed using several vicril interrupted sutures. These sutures are applied between the flap of the stomach to the borders of the separated muscle on both sides of the myotomy. This results a flap of the stomach that completely covers the bulge of the mucosa caudal to the diaphragm.

At the end of the procedure a methylene blue test is performed using 200 cc injected through a nasogastric tube to make sure there is no leak in the mucosal layer. A 10 mm JP drain is left at the site of the EGJ. The robotic arms and the articulating retractor are removed carefully, the abdomen is dessuflated and the robot is withdrawn. The 12 mm ports are sutures closed with 0–1 vicril sutures and the skin is closed with staples. The nasogastric tube is removed at the end of procedure.

RESULTS

We performed surgery on 30 patients between June 2012 and May 2018. There were 15 females and 15 males. Mean age was 53 years.

Mean operative time was 77 minutes (range 47-109), including docking time of the robotic system. There were no cases of morbidity or mortality. There were no cases of intra-operative perforation of the mucosa. There were no cases of conversion to laparoscopic or open surgery. Postoperative course: the nasogastric tube was removed at the end of the surgery.

Soft diet was resumed on postoperative day 1. Patients did not undergo routine swallow test after the operation. Mean follow-up time was 30 weeks (range 12–60 weeks).

Good postoperative result were achieved in 25 patients; 4 patients required additional intervention (3 patients had endoscopic dilatations and 1 patient with known preoperative type 4 Achalasia had undergone esophagectomy). One patient was lost to follow-up (resident of another country).

DISCUSSION

Surgical myotomy is the best therapeutic option for patients presenting with achalasia, and the minimally invasive technique is now the preferred method among many surgeons due to improved outcome and significantly less major mucosal tears requiring subsequent intervention [5].

Surgical robots were developed in the 1980s, and since then have been implemented in a growing number of surgical procedures. The first robotic surgery was a neurosurgery procedure (brain biopsy) in 1985, followed by urology (1988) and orthopedics (1992) [14].

The first robotic device approved by the United States Food and Drug Administration (FDA) for intra-abdominal surgery was for a camera holder in 1994. Robotic-assisted laparoscopy has several advantages over laparoscopic surgery, including superior visualization (3D vs. 2D) imaging of the operative field, stabilization of instruments within the surgical field, improved ergonomics for the operating surgeon, and superior articulation [9-11].

Several groups had published series of robotic-assisted Heller myotomy [15-20]. Conversion rate was 0–7% and mean operative time was 177 minutes. The most remarkable finding was a zero rate of intra-operative esophageal perforation in all but one study. That is in comparison to 8-16% intra-operative esophageal perforation during laparoscopic Heller myotomies reported by the same authors, and 10–16% perforation rate published by others [21,22].

Our study included 30 cases and had the same zero rate of intra-operative esophageal perforation as the above mentioned studies. Operative time was shorter and averaged 78 minutes (range 47–109).

The limitations of the study are the small sample size and lack of control group since we rarely perform esophageal myotomies laparoscopically.

CONCLUSIONS

Robotical-assisted Heller myotomy is a safe technique with a lower rate of intra-operative esophageal perforation compared to the laparoscopic approach. In spite of increased costs and relative increase in operative time, the technical advantages of the robotic assisted technique may have potential advantage over the standard laparoscopic technique. These advantages are the main reason for the more accurate dissection that result zero injury to the mucosa with its dire consequences if missed. We believe robotic-fassisted surgery is the procedure of choice to treat achalasia.

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Capsule

Resurgence of Ebola virus in 2021 in Guinea suggests a new paradigm for outbreaks

Seven years after the declaration of the first epidemic of Ebola virus disease in Guinea, the country faced a new outbreak between 14 February and 19 June 2021 near the epicentre of the previous epidemic. **Keita** and colleagues use next-generation sequencing to generate complete or near-complete genomes of *Zaire ebolavirus* from samples obtained from 12 different patients. These genomes form a well-supported phylogenetic cluster with genomes from the previous outbreak, which indicates that the new outbreak was not the result of a new spillover event from an animal reservoir. The 2021 lineage shows considerably lower divergence than would be expected during sustained human-to-human transmission, which suggests a persistent infection with reduced replication or a period of latency. The resurgence of *Zaire ebolavirus* from humans five years after the end of the previous outbreak of Ebola virus disease reinforces the need for long-term medical and social care for patients who survive the disease, to reduce the risk of re-emergence and to prevent further stigmatization.

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Capsule

Immunogenicity and safety of a 3-antigen hepatitis B vaccine vs. a single-antigen hepatitis B vaccine

The recombinant 3A-HBV, Sci-B-Vac, contains three HBV surface antigens: pre-S1, pre-S2 and S. The 1A-HBV contains only the small S antigen (HBsAg). A prior phase III trial, PROTECT, found the 3A-HBV to be "highly immunogenic for adults, including older adults with well-controlled chronic conditions," the authors noted. **Diaz-Mitoma** and colleagues examined data from 2,838 healthy adults ages 18–45 years who were vaccinated at 37 sites in Finland, the United Kingdom, Belgium, Germany, Canada, and the United States from December 2017 to October 2019. They were randomized 4:1 to receive three intramuscular injections of 3A-HBV (10 µg) or 1A-HBV **(20 µg)** at days 0, 28, and 168. There were three 3A-HBV lot groups to determine lot-to-lot manufacturing consistency. The main outcome assessed the immunogenicity of the 3A-HBV compared to the 1A-HBV, evidenced by mean serum concentration of anti-HB concentrations 4 weeks following the third injection. Noninferiority of pooled seroprotection rates was a secondary outcome. Anti-HB concentrations rose between the second and third doses of both vaccines, though antibody levels peaked at day 196 in the 3A-HBV group and was 3.5-fold greater than antibody levels among those who received 1A-HBV.After three doses, the pooled seroprotection rate of all three groups who received the 3A-HBV (99%, 95%CI 98.7%–99.6%) was noninferior to the 1A-HBV group (95%, 95%CI 92.7%–96.4%). Approximately 68% of participants in the 3A-HBV group and 60% in the 1A-HBV group reported systemic adverse events (AEs) within 7 days of any injection. The median duration of symptoms was about 2 days. Serious AEs were reported in 42 participants (2%) in the 3A-HBV group and four participants (0.4%) in the 1A-HBV group. The 3A-HBV was associated with a greater incidence of local AEs within 1 week (erythema, pain, pruritus). According to the authors, the vaccine was licensed in Israel.

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