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Short-term outcomes

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Surgical myotomy and anterior fundoplication for achalasia disease. Short-term outcomes

AIM: Achalasia is a well-known disease among esophageal motility disorders, and all treatments for this disease are aimed at relaxing the lower esophageal sphincter (LES). Recently, endoscopic and surgical myotomy techniques are used more frequently because they give better results than other conservative techniques. In this study, we aimed to present the early results of surgical myotomy and anterior fundoplication techniques in the treatment of achalasia-related dysphagia.

METHODS: Our study enrolled patients who operated with laparoscopic myotomy and anterior fundoplication for achalasia between 2014 and 2019. Patients' demographic and clinical properties, operative details, and postoperative short-term outcomes were retrospectively analyzed.

RESULTS: A total of 25 patients (11 women, 14 men) were enrolled. The mean age was 40.72 ± 13.6 (range 18-66) years. The mean LES pressure was 26.6 ± 11.2 (range 16-50) mmHg. The mean esophageal myotomy length was 7.83 ± 1.88 (range 7-12 cm). Esophagus perforation developed in one patient during myotomy. The mean time to start oral feeding was 2.56 ± 0.76 (range 2-4) days, and the mean length of hospital stay was 4.96 ± 1.17 (range 3-8) days. During the follow-up, symptom regression was observed in 92 % of patients at the end of a 1-year.

CONCLUSION: According to our results and available literature, myotomy with Dor fundoplication is an effective technique that can be used to treat achalasia disease.

KEY WORDS: Achalasia, Dor fundoplication, Heller myotomy

Introduction

Achalasia is a condition characterized by failure of both peristalsis and relaxation of the lower esophageal sphincter (LES) ¹. Achalasia disease was first described as "esophageal sphincter spasm" by Sir Thomas Willis in 1674. The incidence of Achalasia disease in women and men is 1 per 100.000 people and 10 per 100.000 people, respectively. It is most commonly seen between the ages of 30 and 60 years ^{2,3}.

Achalasia disease is the most common of esophageal motility disorders. Although its exact cause is still unknown, autoimmunity, neurodegenerative disorders, or previous viral infection are being implicated ⁴. The main purpose of all techniques such as Botulinum toxin injection, pneumatic dilation (PD), surgical myotomy or oral endoscopic myotomy in the treatment of achalasia; to relieve lower esophageal sphincter (LES) and to facilitate esophageal emptying. Recently, minimally invasive surgical myotomy and endoscopic myotomy techniques are preferred more frequently because they lead to better results compared to other conservative techniques ^{5,6}.

In the present study, we aimed to report the short-term results of Heller myotomy + anterior fundoplication (Dor fundoplication) technique, which we performed to treat achalasia patients who were referred to our clinic after unsuccessful conservative treatment attempts.

The main limitations of the present study are the incomplete determination of achalasia subtypes due to using conventional esophagus manometry and a retrospective study design.

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Methods

This study included achalasia patients who applied to our clinic after unsuccessful conservative treatment and treated surgically between 1 January 2014 and 01 February 2019. Patients under the age of 18, esophageal strictures due to ingestion of caustic substances, gastric or esophageal cancers, and esophageal motility disorders other than Achalasia were excluded from the study.

The diagnosis of achalasia was made by our hospital's gastroenterology clinic, based on findings of contrast-enhanced esophagography, esophagogastrosopy, and esophageal motility tests (conventional manometric study). The medical records of all patients were retrospectively reviewed the hospital's database. Preoperative Eckardt scores⁷ of the patients were determined. Follow-up results were reinforced with telephone calls with the patients. Demographic features, body mass index (BMI), comorbidities, American Society of Anesthesiologists (ASA) score, previous conservative treatment status (Botox injection, pneumatic dilatation or drug therapy), LES pressure (mm/hg), myotomy length (cm), operative time, intraoperative complications, rate of conversion to open surgery, postoperative complication status, length of postoperative hospital stay, 30-day mortality, 90-day unplanned hospital readmission rate, re-operation status, dysphagia status at follow-up, and change of symptoms according the Eckardt Scores were determined at the end of 1 year were recorded.

ETHICS

This study was carried out after the approval of the Cukurova University Faculty of Medicine Ethics Committee dated 04.09.2019 and no 91/28.

LAPAROSCOPIC SURGICAL TECHNIQUE

All patients were operated in French position under general anesthesia. Cephazoline Sodium was injected intravenously before induction of anesthesia as a prophylaxis. After a urinary catheter and a nasogastric tube were inserted, the abdominal cavity was entered with a Veress needle immediately under the umbilicus and pneumoperitoneum was created. Two No 10 trochars (Versaport®, Covidien Health Care, USA), two No 5 trochars, and a Nathanson retractor to retract the liver were inserted.

A 30 degrees lens was used for the camera. In order to perform Dor fundoplication, one or two short gastric vessels were sealed and cut with the help of an energy device, and the gastric fundus was mobilized. The esophagus was suspended while both vagal nerves were preserved. After the right Vagus nerve was lateralized to the patient's right, a full-thickness myotomy of 6-8 cm in

length was performed over the esophagus, which was then extended 3 cm over the stomach (Fig. 1).

After myotomy, the only mucosa remained on the anterior surface of the esophagus. The adequacy of myotomy and the presence of a potential perforation was tested with 200 ml methylene blue that was injected through a tube placed to the esophageal mid-portion. Mucosa perforation was repaired with 4/0 absorbable sutures (Fig. 2). Dor fundoplication was performed on the anterior aspect of the esophagus using a 3/0 non-absorbable suture material (Fig. 3).

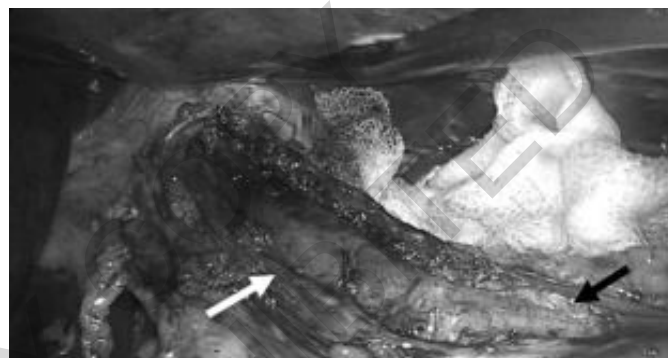


Fig. 1: The white arrow shows esophageal a full-thickness myotomy of 6-8 cm in length and the myotomy, extended 3 cm over the stomach (the black arrow).

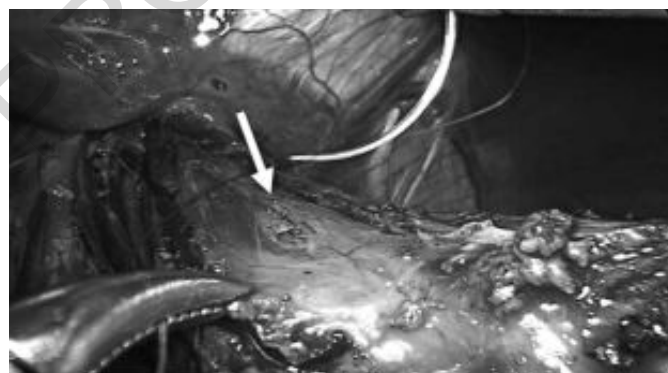


Fig. 2: Mucosal perforation indicated with the white arrow.



Fig. 3: Dor fundoplication was performed on the anterior aspect of the esophagus. The yellow arrow shows lateralized vagal nerve, the black arrow shows lateralized longitudinal and circular muscle fibers and the blue arrow indicated mucosa.

POSTOPERATIVE FOLLOW-UP

On the first postoperative day, all patients underwent esophageal passage film. According to imaging, patients without suspicion of stricture or leakage were started a liquid diet on postoperative day 1. All patients without contraindications for discharge were sent home on the second postoperative day. All patients were prescribed a proton pump inhibitor for one month after surgery, and a soft food diet was recommended for 2 weeks.

STATISTICAL ANALYSIS

Statistical analysis of the study data was performed using IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA) software package. Categorical variables were reported as number and percentage, and continuous numeric variables as mean and standard deviation (minimum-maximum whenever indicated).

Results

This study enrolled 25 patients (11 women, 14 men). The mean age was 40.72 ± 13.6 (range 18-66) years. The most common ASA score was 2 (n:14). The comorbidities

asthma hypertension, and diabetes mellitus. In previous treatment stories, 9 patients had pneumatic dilatation and 3 patients received Botulinum toxin injection in another center (Table I).

The mean body mass index was 25.12 ± 6.16 . The mean LES pressure was 26.6 ± 11.2 (mmHg). The mean operative time was 164 ± 48.5 (range 90-255) minutes. The mean esophageal myotomy length was 7.83 ± 1.88 (range 7-12). No procedure was converted to open surgery. The mean time to start oral feeding was 2.56 ± 0.76 days, and the mean length of hospital stay was 4.96 ± 1.17 days (Table II).

Esophagus perforation developed during myotomy in one patient and was repaired with a 5/0 absorbable suture. One patient developed a postoperatively diagnosed pneumothorax, and two patients developed atelectasis. One patient was re-operated with a loosening of anterior fundoplication for difficulty swallowing at the early postoperative period. One patient was re-admitted after discharge due to difficulty swallowing and treated medically. No patient died due to procedural factors. At the end of a 1-year follow-up, 92% of patients reported were no dysphagia. Two patients suffered from recurrent achalasia, one was treated with PD and the other with pharmacological therapy. Preoperative Eckardt Scores was 10.2 ± 4.16 (range 5-12) and at the end of 1 year, it was 2.21 ± 1.15 (range 0-3) (Table III).

TABLE I - Clinical features

Variable	N	(%)
Age (year) std, (min-max)	$40.72 \pm 13.6(18-66)$	
Sex		
Male	14	56%
Female	11	44%
ASA score		
1	10	40%
2	14	56%
3	1	4%
Comorbid disorders		
Hypertension	3	12%
Diabetes mellitus	2	8%
Asthma	3	12%
Previous Treatment		
Pneumatic Dilatation	9	36%
Botox	1	4%
Medical	15	60%

std: Standard deviation, ASA: American Society of Anesthesiologists, BMI: Body Mass Index, LES: Lower Esophageal Sphincter, mm: Millimeter.

TABLE II - Operative Details

Variable	Mean+std, (min-max)
BMI	25.12 ± 6.16 (14-39,1)
Mean LES (mmHg)	$26.6 \pm 11,2$ (16-50)
Operative time (min)	$164 \pm 48,5$ (90-255)
Esophageal myotomy (cm)	7.83 ± 1.88 (7-12)
Postoperative time to start oral feeding (day)	2.56 ± 0.76 (2-4)
Postoperative length of hospital stay (day)	4.96 ± 1.17 (3-8)
Eckardt Scores	
Preoperative	10.2 ± 4.16 (5-12)
At the end of 1 year	2.21 ± 1.15 (0-3)

min: Minutes, cm: Centimeter

TABLE III - Postoperative features

Variable	N	(%)
Postoperative complication		
Atelectasis	2	8%
Pneumothorax	1	4%
Intraoperative complication		
Esophagus perforation	1	4%
90-day unplanned hospital readmission		
Difficulty swallowing	1	4%
Early postoperative reoperation		
Difficulty swallowing	1	4%
Resolution of symptoms	23	92%
Recurrence after 1 year		
Treated with PD	1	4%
Treated with medical	1	4%

Discussion

The main problem with the achalasia disease is the denervation of the esophageal muscular layer. This results in impaired relaxation of the LES and aperistalsis. The primary goal of the treatment for achalasia disease is to eliminate dysphagia and to reduce the pressure of LES with impaired relaxation, and to allow esophageal emptying to prevent the development of megaesophagus^{8,9}. For this purpose, conventional therapies (drugs, Botox therapy, and pneumatic dilatation), surgery, and recently popularized endoscopic myotomy technique are currently used to treat achalasia¹⁰. On the other hand, none of the conventional therapies are fully effective for the correction of impaired LES relaxation. Furthermore, the question of who needs which treatment can only be addressed by an accurate typing of achalasia disease. Chicago 2012 classification is used to determine the subtypes of achalasia disease. Considering the current guidelines for the Chicago classification, the use of high-resolution manometers instead of conventional manometry devices is the norm^{11,12}. Whereas the results of conventional manometry group esophageal motility disorders into 4 groups by (achalasia, diffuse esophageal spasm, Nutcracker esophagus, and non-specific motility disorders not meeting the criteria of hypertensive LES), high-resolution manometry divides even achalasia alone into three subtypes with distinctive treatments¹³. In our study, most patients had been diagnosed by the conventional manometry testing at respective gastroenterology departments, where the mean LES pressure had been found above 16 mmHg in all of them. In our study, the mean LES pressure was 26.6±11.2 (range 16-50) mmHg.

TRENDS IN THE USE OF BOTULINUM TOXIN INJECTION

Among conventional treatment modalities, one of the most commonly utilized pharmacological treatment agents is botulinum toxin. This toxin provides relaxation of the sphincter tonus by preventing acetylcholine release from nerve terminals¹⁴. Whereas a clinical response is observed in 80% of cases by one month, that response quickly fades away, with less than 60% of patients remaining asymptomatic at the end of 1 year¹⁵. Thus, it would be an appropriate approach to select that treatment for high-risk patients deemed unsuitable for surgical myotomy. One of our patients tried to be treated with botulinum toxin injection before, but this treatment was unsuccessful.

TRENDS IN THE USE OF ENDOSCOPIC PNEUMATIC DILATATION

Pneumatic dilatation is one of the most commonly preferred non-surgical techniques for achalasia treatment. It

is recommended particularly for type 2 achalasia, and its advantages over surgical treatment include a lower cost and a less invasive nature¹⁶. It aims to stretch and break muscle fibers circumferentially, thereby to reduce LES pressure¹⁷. Despite this, a considerable percentage of patients undergoing PD requires re-treatment in the coming years^{18,19}. Esophageal perforation or gastroesophageal reflux disease may be considered as the disadvantages of the PD procedure²⁰. Although it appears as a cost-effective option, several studies have reported that signs of inflammation seen in patients previously treated with pneumatic dilatation or Botox injection would complicate surgical technique and, as a result, increase the likelihood of suffering intraoperative perforation^{21,22}. Patients who suffer perforation may have a higher rate of morbidity and even mortality. Therefore, repair with the open technique is usually a more widely accepted approach but it should be noted that performing thoracotomy for this purpose would bring extra morbidity. Even though 36% (n=9) of our patients had been treated with pneumatic dilatation at least one and at most three times before, their symptoms of dysphagia recurred at least 2 months and at most 1 year after the treatment.

TRENDS IN THE USE OF PERORAL ENDOSCOPIC MYOTOMY

In recent years, peroral endoscopic myotomy (POEM) technique, a type of natural orifice transluminal endoscopic surgery, has gained popularity for achalasia treatment, and a plethora of articles have been reported²³⁻²⁵. Unlike surgical myotomy, the POEM technique does not involve any anti-reflux procedure; hence, patients undergoing POEM may develop gastroesophageal reflux disease that adversely affects the quality of life. In the case of POEM, however, better outcomes have been reported with repeat myotomy performed at the posterior aspect of the esophagus among patients suffering type III achalasia or "end-stage achalasia such as megaesophagus or sigmoid esophagus", who responded poorly to conventional therapies or did not benefit from surgical myotomy^{26,27}. One of the key aspects of POEM to remember is that most of the studies on POEM have involved small patient groups and been performed by highly specialized centers; another key point is that there is a lack of randomized studies comparing POEM with conventional achalasia treatments such as laparoscopic Heller myotomy and PD. There is a continuous debate as to the incidence and importance of gastroesophageal reflux disease after POEM.

LAPAROSCOPIC MYOTOMY

Currently, laparoscopic Heller myotomy surgery is the leading treatment modality in the surgical treatment of

achalasia. Surgical myotomy procedure aims at muscle fibers of LES, which involves 6 cm on the esophagus and extends 2-3 cm to the stomach; it may be performed in an open, laparoscopic, or robotic fashion (28,29). In our study, the mean esophageal myotomy length was 7.83 ± 1.88 (range 7-12 cm).

Myotomy is effective in symptom relief in 80-90% of patients at medium-term follow-up (more than 12-36 months) ^{29,30}. The advantage of surgical myotomy over the other techniques is the opportunity it offers to add a partial fundoplication and the ability to be combined with an anti-reflux procedure. Both anterior (Dor) and posterior (Toupet) partial fundoplication techniques may be preferred for preventing post-myotomy reflux disease. There is no consensus yet as to which procedure is superior to the other. Dor procedure prevents gastric mobilization at the first dissection and is technically more feasible. Its biggest advantage is the ability to support inadvertent esophageal perforation should the latter occur. The advantage of Toupet fundoplication is the ability to lessen the amount of fibrosis in the myotomy region, thus reducing the rate of dysphagia compared to anterior fundoplication. Rohof et al. performed a randomized study in 43 patients, and they showed that adding Dor fundoplication reduced the incidence of gastroesophageal reflux (9% vs 48%) ³¹. Douard and colleagues found that without a fundoplication, the incidence of pathological reflux was 47%. The addition of an anterior 180 degree Dor fundoplication reduced this to 9% without any effect on postoperative dysphagia or reduction of LES pressure ³². In our study, twenty-five of our patients were operated with laparoscopic Heller myotomy and Dor fundoplication. The reason of choosing Dor procedure is technically more feasible and it creates a supportive tissue should a mucosal perforation develop. One of 25 patients undergoing laparoscopic Heller myotomy developed esophageal perforation. Four patients developed atelectasis and one patient pneumothorax postoperatively which required only medical treatment. We found a mean time to start oral feeding of 2.56 days, with the patient having delayed that time was the one who developed esophageal perforation. The mean length of hospital stay was 4.96 ± 1.17 (3-8) days. Dysphagia is a late complication of Heller myotomy and fundoplication. It usually starts six months or later after surgery and affects about 3-10% of patients ^{33,34}. Its most common cause is inadequate myotomy. Other reasons include late scarring of myotomy and an excessively tight anti-reflux dressing. In our study, one patient with early dysphagia who required re-operation was operated by loosening anterior fundoplication. Symptom recurrence usually occurs at one year or beyond after Heller myotomy. Patients with signs of recurrence can be treated by graded PD or re-myotomy ³⁵. We questioned Eckardt scores to patients and found a recovery rate of 92% at a 1-year follow-up. Two patients who had difficulty swallowing experienced recur-

rence during their first-year follow-up, one was treated with PD and the other with pharmacological therapy.

Conclusion

According to our findings and the current literature reports, combined laparoscopic Heller myotomy and Dor fundoplication techniques may perform in achalasia treatment with a low morbidity and recurrence. Optionally adding anti-reflux procedure as Dor or Toupet fundoplication shows a beneficial effect on reflux symptoms.

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