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RESEARCH AND APPLICATION OF LAPAROSCOPIC HELLER MYOTOMY WITH FUNDOPLICATION FOR ACHALASIA

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1. Hai Phong University of Medicine and Pharmacy Library
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LIST OF PUBLICATIONS RELATED TO THE THESIS TOPIC

1. **Nguyen Van Thuy, Nguyen Van Huong, Pham Van Duyet** (2024). Clinical and subclinical characteristics of Achalasia patients at Nghe An General Friendship Hospital, Vietnam Medical Journal, Volume 545 **(2)**, December 2024, pp. 58-63.

2. **Nguyen Van Thuy, Nguyen Van Huong, Pham Van Duyet** (2025). Evaluation of the results of laparoscopic Heller myotomy with fundoplication for Achalasia at Nghe An General Friendship Hospital, Vietnam Medical Journal, Volume 549 **(3)**, April 2025, pp. 311 - 315.

3. **Nguyen Van Thuy, Nguyen Van Huong, Pham Van Duyet et al** (2025), "Clinical outcomes and quality of life in patients undergoing laparoscopic Heller myotomy combined with fundoplication for achalasia", *Romanian Journal of Medical Practice – Vol 20*, **3(105)**, p 270 - 274.

INTRODUCTION

Achalasia is a rare, chronic esophageal motility disorder characterized by the insufficient relaxation of the lower esophageal sphincter (LES) and the loss of esophageal peristalsis. The global incidence rate ranges from 0.03 to 1.63 per 100,000 population per year. The disease has a complex and unclear mechanism and is often misdiagnosed as other conditions.

There are various treatment options for Achalasia, among which laparoscopic Heller myotomy (LHM) with fundoplication (Dor or Toupet) is considered the gold standard treatment due to its long-lasting efficacy.

In Vietnam, this technique has been applied since 2003 with promising results. However, at Nghe An General Friendship Hospital, although the procedure has been implemented since 2014, there has been no research to evaluate it. Therefore, the study titled "Research and application of laparoscopic Heller myotomy with fundoplication for Achalasia" with two objectives:

1. Describe the clinical and subclinical characteristics and the technique laparoscopic Heller myotomy with Dor fundoplication for Achalasia.
2. Evaluate the results of laparoscopic Heller myotomy with Dor fundoplication for Achalasia at Nghe An General Friendship Hospital.

Scientific and practical significance of the thesis:

Laparoscopic Heller myotomy with Dor fundoplication is considered a safe and long-lasting effective treatment for achalasia.

Therefore, in-depth studies are needed to optimize surgery techniques, enhance treatment outcomes, and minimize complications.

The thesis demonstrates that laparoscopic Heller myotomy with Dor fundoplication is a safe and effective technique for treating achalasia and is feasible to perform at provincial-level hospitals.

Dissertation layout:

The thesis consists of 147 pages: 2 pages of introduction, 38 pages of literature review, 28 pages of research objects and methods, 30 pages of research results, 46 pages of discussion, 2 pages of conclusion, and 1 page of recommendations.

The thesis contains 40 tables, 7 charts, 2 diagrams and 33 figures, along with 107 references (13 in Vietnamese and 94 in English).

CHAPTER 1. LITERATURE REVIEW

1.1. Anatomical and physiological characteristics of the esophageal cardia and applications

1.1.1. Esophageal cardiac anatomy

The lower esophageal sphincter (LES) is a segment of smooth muscle at the end of the esophagus that thickens into a functional "valve" to prevent the reflux of gastric fluids. This complex structure is innervated by both the parasympathetic and sympathetic nervous systems.

1.1.2. Physiology of the esophageal cardia

Normally, the LES functions as a one-way valve, allowing food to pass down while preventing reflux. This function depends on the intrinsic pressure of the LES, pressure from the diaphragm, and other anatomical structures. When these factors become dysfunctional, it can cause reflux. After food enters the esophagus, the LES relaxes. The LES also participates in other activities like vomiting and belching.

1.1.3. Achalasia

Achalasia is a primary, chronic esophageal motility disorder that causes loss of peristalsis and incomplete relaxation of the lower esophageal sphincter. It is a rare disease, typically occurring between the ages of 30 and 60. The pathogenesis is primarily due to the loss of inhibitory neurons in the myenteric plexus, leading to dysfunction of the lower esophageal sphincter and esophageal peristalsis.

1.2. Clinical and paraclinical characteristics of achalasia

1.2.1. Clinical symptoms

Functional symptoms:

▪ Dysphagia: This is the classic symptom, initially vague, but later occurring frequently with both solid and liquid foods.

▪ Vomiting: Becomes pronounced as the disease progresses due to food stagnation in the esophagus.

▪ Chest pain: A feeling of pressure behind the sternum, unrelated to exertion.

▪ Weight loss: Occurs over a prolonged period due to difficulty eating.

▪ Heartburn: May be present, but is not typical and can be easily confused with GERD.

▪ Eckardt Score: A tool used to assess disease severity based on the above symptoms.

- *Physical Signs:*

▪ Respiratory symptoms: Complications like aspiration pneumonia may occur.

▪ Chin-jut sign: Patients jut their chin forward in an attempt to swallow.

1.2.2. Diagnostic imaging

- Barium Swallow Esophagogram: This is a highly valuable method, showing the classic "bird-beak" sign at the cardia and retention of contrast media. This technique helps to grade esophageal dilation from grade I to grade IV.

- Flexible Esophagogastroduodenoscopy (EGD): Used to rule out other pathologies, such as tumors. In the early stages, the esophagus may appear normal, but in advanced stages, it appears dilated, tortuous, with food retention and esophagitis.

- Computed Tomography (CT) Scan of the Chest and Abdomen: Indicated when secondary causes (pseudo-achalasia) or malignant factors are suspected. It helps to detect compressing tumors or complications.

1.2.3. Esophageal manometry

High-resolution manometry (HRM) is the gold standard for diagnosing achalasia. This technique evaluates an elevated resting LES pressure and incomplete relaxation during swallowing, while also noting the absence of esophageal peristalsis. Based on the results, the disease can be classified according to the Chicago Classification into Type I, II, and III.

1.2.4. Other exploration methods

- Esophageal Impedance Monitoring: Supports the diagnosis of achalasia in ambiguous cases where manometry is not conclusive.

- Plain Chest and Abdominal X-ray: Classic signs include the absence of a gastric bubble (50%), an air-fluid level in the posterior mediastinum, a widened mediastinum, and chronic lung parenchymal changes.

1.2.5. Diagnostic criteria

With HRM: Clinical symptoms (typical dysphagia), HRM (reduced/absent LES relaxation, loss of esophageal peristalsis), X-ray

(classic "bird's beak" sign, contrast retention), Endoscopy (to rule out other causes).

Without HRM: Clinical symptoms (characteristic, prolonged dysphagia that does not respond to medical and endoscopic interventions), X-ray (classic "bird's beak" sign, contrast retention), and/or Endoscopy (to rule out other causes, spastic cardia, esophageal dilation/retention).

1.2.6. Treatment methods

Treatment for achalasia involves several methods aimed at reducing symptoms, improving quality of life, and preventing disease progression:

- *Medical Treatment:* Uses calcium channel blockers and nitrates, but their efficacy is low and they are associated with numerous side effects.

- *Interventional Treatment:*

▪ Botulinum toxin injection: Injected into the lower esophageal sphincter. Its effect lasts for about 6 months, requiring repeated injections. It is suitable for patients with a high surgical risk.

▪ Pneumatic dilation (PD): Involves rupturing the circular muscle fibers. It is effective but carries a risk of esophageal perforation.

▪ Peroral endoscopic myotomy (POEM): An advanced and highly effective technique, but it requires specialized skills and carries a risk of GERD.

- *Surgical Treatment:* Laparoscopic Heller myotomy (LHM) is a long-term, effective treatment and is considered the first-line option.

This technique is often combined with a Dor or Toupet antireflux fundoplication to reduce the risk of GERD.

Surgical Indications: Low-risk patients with achalasia types I, II, or type III (when POEM is not an option or when medical/endoscopic interventions have failed).

Surgical Contraindications: ASA > 3, pregnancy, severe cardiovascular/respiratory/hepatic/renal disease, esophageal/gastric cancer, a history of complex abdominal surgery, local infection, coagulopathy, or an unstable psychological condition.

1.3. The technique for laparoscopic Heller myotomy with Dor fundoplication

1.3.1. Indications and contraindications for laparoscopic Heller myotomy with Dor fundoplication

- *Indications:*

▪ According to the Chicago Classification: Achalasia type I and type II. Achalasia type III (if the patient does not consent to POEM or requires long-term PPI use).

▪ Failure of medical/endoscopic interventions.

▪ Recurrence after endoscopic intervention.

▪ Based on clinical and X-ray findings (when HRM is unavailable): Eckardt score ≥ 3 with a "bird's beak" sign on X-ray, contrast retention, and esophageal dilation of Grade I, II, or III (at the time of diagnosis) or Grade IV (if treatment has failed or if the medical facility is not equipped for POEM).

- *Contraindications:* ASA > 3, pregnancy, end-stage cardiovascular/respiratory/hepatic/renal disease, uncontrolled diabetes mellitus, systemic infection, esophageal/gastric cancer, severe esophagitis with stricture, Barrett's esophagus with high-grade dysplasia/carcinoma in situ, history of multiple complex abdominal surgeries causing adhesions, local abdominal wall infection, coagulopathy, and an unstable psychological condition.

1.3.2. Application of laparoscopic Heller myotomy with Dor fundoplication technique

- Purpose and Principles: To divide the muscle bundles of the LES complex to relieve esophageal outlet obstruction. Completely incise the circular and longitudinal muscle fibers of the lower esophageal segment, as well as the sling and clasp fibers of the gastric cardia.

- Technical Procedure:

▪ Position and Instruments: The patient is in a supine position with the head tilted up at 30 degrees. The surgeon stands on the patient's left side, using 5 trocars.

▪ Heller Myotomy: The muscle is incised using an ultrasonic scalpel or an electrocautery knife. The incision is approximately 4-6 cm long on the esophageal side and 1-2 cm on the gastric side. During the surgery, the mucosa is checked using air insufflation or an endoscope.

▪ Dor Fundoplication: A 180-degree anterior fundoplication is created to cover the myotomy incision and prevent reflux.

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1.4. Study on the results of laparoscopic Heller myotomy with Dor fundoplication for Achalasia

1.4.1. World

Many studies have evaluated the results of LHM combined with Dor fundoplication.

Kazuto Tsuboi (2006): Average surgical time of 169.1 minutes. Mucosal perforation rate of 14%.

Rebecchi (2008): Compared Dor and Nissen fundoplication, Dor had a significantly lower rate of postoperative dysphagia.

Aiolfi (2020): Compared Dor and Toupet fundoplication, the rates of reflux and dysphagia were similar, but Dor was more effective in preventing mucosal diverticula.

1.4.2. Viet Nam

Surgical treatment for achalasia in Vietnam has been performed since 1955.

Do Truong Son (2016): Studied 120 patients, with 5.8% converting to open surgery and 4.4% experiencing mucosal perforation. Concluded that Dor fundoplication has many advantages.

Phan Dinh Tuan Dung (2020): Studied 11 patients, with an average surgical time of 148 minutes. No complications were reported. 10 out of 11 patients achieved good results after 3 and 6 months.

CHAPTER 2. RESEARCH OBJECTS AND METHODS

2.1. Research subject

Patients with Achalasia underwent laparoscopic Heller myotomy combined with Dor fundoplication at Nghe An General Friendship Hospital from September 2020 to August 2024.

2.1.1. Selection criteria

- Confirmed diagnosis of achalasia based on clinical findings, barium swallow esophagography, esophageal endoscopy, and CT scans.
- Achalasia that failed to respond to medical or endoscopic interventions.
- Treated with laparoscopic Heller myotomy with Dor anti-reflux fundoplication at Nghe An General Friendship Hospital from September 2020 to August 2024.
- Consented to participate in the study.
- Had complete medical records according to the study criteria.

2.1.2. Exclusion criteria

- Intra- and postoperative diagnosis is not achalasia.
- Patients with medical conditions that prevent them from controlling their behavior.

2.2. Location and time of research

- Location: Nghe An General Friendship Hospital.
- Time: From September 2020 to March 2024

2.3. Research methods

2.3.1. Study design

Clinical interventional study, prospective, uncontrolled study.

2.3.2. Sample size

The calculation was based on the formula for estimating a single proportion in a population, with an estimated success rate of 94% and a permissible error of 8%. The minimum required sample size was 34 patients. The study enrolled 39 patients.

2.4. Technical process

2.4.1. Definitive diagnosis

Based on clinical symptoms (dysphagia, chest pain, regurgitation, weight loss) and subclinical findings (barium swallow esophagography, esophagogastroduodenoscopy, chest and abdominal CT scan).

2.4.2. Surgical indications

- Based on clinical guidelines from the Seoul Consensus 2019, European Society of Gastrointestinal Endoscopy 2020, and the American Gastroenterological Association 2020.
- Clinical symptoms are uncontrolled (Eckardt score ≥ 3) after medical or endoscopic interventions (pneumatic dilation or botulinum injection).
- Typical dysphagia symptoms (Eckardt score ≥ 3) with X-ray findings of a "bird's beak" sign, contrast retention, and esophageal dilation Grade I, II, or III at the time of diagnosis.
- Typical dysphagia symptoms (Eckardt score ≥ 3) with X-ray findings of a "bird's beak" sign, contrast retention, and esophageal dilation Grade IV that has failed medical and endoscopic interventions.
- Consider this as the initial treatment for patients with typical dysphagia (Eckardt score ≥ 3) with X-ray findings of a "bird's beak"

sign, contrast retention, and esophageal dilation Grade IV when the medical facility is not equipped for POEM.

2.4.3. Contraindications to surgery

- Achalasia patients with high surgical risk (ASA > 3).
- Currently pregnant.
- Patients with severe, unstable cardiovascular disease (severe heart failure, recent myocardial infarction, dangerous cardiac arrhythmias).
- Patients with severe, uncontrolled chronic respiratory disease (end-stage COPD, severe asthma).
- End-stage liver or kidney failure. Patients with other severe medical conditions (uncontrolled diabetes, severe systemic infection). Coagulopathy: A bleeding disorder.
- Esophageal cancer, gastric cancer, severe esophagitis with stricture, Barrett's esophagus with high-grade dysplasia or carcinoma in situ.
- History of multiple abdominal surgeries causing complex adhesions, such as for peritonitis or bowel obstruction. Local infection of the abdominal wall. Coagulopathy.
- Unstable psychological condition, uncooperative.
- Unstable psychological condition: An uncooperative mental state.

2.4.4. Laparoscopic Heller myotomy with Dor fundoplication technique

- Patient position, surgeon's position and trocars: The patient is in a supine position with legs apart and the head elevated. The surgeon stands on the patient's left side, the assistant stands on the patient's

right side, the camera assistant stands between the patient's legs, and the scrub nurse stands to the right of the surgeon. 5 trocars are used.

- Surgical steps: The surgical procedure includes 7 steps.

Step 1: Trocar placement: Place the 5 trocars as described and insufflate the abdomen with CO2 to create a working space.

Step 2: Exploration and assessment of the esophagogastric region: Release any adhesions in the cardio-esophageal region and the abdominal esophagus. Clearly identify the boundary between the esophagus and the stomach.

Step 3: Mobilization of the gastric fundus: Use an electrocautery or an ultrasonic scalpel to dissect the greater omentum along the greater curvature of the stomach, starting from the short gastric arteries and moving upwards to the left crus of the diaphragm.

Step 4: Heller myotomy: Perform the myotomy using an ultrasonic scalpel, guided by a Kelly clamp. The incision should start about 1-2cm above the Z-line at the 11 o'clock position, extending approximately 4-6cm on the esophagus and 2-3cm on the stomach, ensuring all circular and longitudinal muscle fibers of the LES are divided. The total length of the myotomy is about 6-8cm. Check the esophageal and gastric mucosa by insufflating air or using an intraoperative endoscope to detect and promptly manage any mucosal injury.

Step 5: Dor fundoplication: Wrap a portion of the gastric fundus (approximately 180 degrees) over the anterior surface of the incised esophagus and secure it with 6 sutures between the fundus and the edges

of the myotomy, including a part of the diaphragmatic crus. Add 1-2 more sutures between the top of the diaphragmatic hiatus and the fundus.

Step 6: Abdominal washout and drain placement (if necessary).

Step 7: Trocar site closure.

2.5. Research indicators

- General characteristics: Age, gender, occupation, geography, medical history, BMI, ASA score.
- Clinical and subclinical findings: Dysphagia, regurgitation, chest pain, weight loss, Eckardt score, heartburn, extra-esophageal symptoms, SF-36 score, barium swallow esophagography, endoscopy, CT scan, chest/abdominal X-ray, blood tests.
- Results of surgical technique application: Position, trocar placement, myotomy length, intraoperative difficulties, drain placement, conversion to open surgery, complications, blood loss, surgical time.
- Early postoperative outcomes: Time to removal of tubes/drains, time to first flatus, time to oral feeding, length of hospital stay, pain level, use of analgesics/antibiotics, complications.
- Long-term follow-up outcomes: Follow-up duration, clinical success/failure, recurrence, changes in symptoms, Eckardt score, heartburn, esophageal diameter, endoscopy, supportive treatment, quality of life, satisfaction level, symptom-free survival time.

2.6. Data processing

- Data Collection: Based on the sample research medical records.

- Data Processing: Using SPSS 26.0. Descriptive statistics were used (mean ± SD, median, frequency, percentage). Analytical statistics were used (t-test, Mann-Whitney U test, Chi-square, Fisher's Exact Test, Wilcoxon signed-rank test, Repeated Measures ANOVA, Paired t-test).

2.7. Research ethics

The study was approved by the doctoral thesis review council of Hai Phong University of Medicine and Pharmacy and the ethics committee of Nghe An General Friendship Hospital (No. 03/BVNA-HDDD dated June 9, 2020). The study ensured honesty, accuracy, confidentiality of patients' personal information, and voluntary participation.

CHAPTER 3. RESEARCH RESULTS

A total of 39 patients who met the inclusion criteria were included in the study, which was conducted at Nghe An General Friendship Hospital between September 2020 and August 2024.

3.1. General characteristics

- Age: The average age was 49.03±16.66 years (range 19-81), with an even distribution. The highest concentration was in the 41-60 age group (35.9%).

- Gender: Females accounted for 69.2%, and males for 30.8% (a male-to-female ratio of 0.44/1).

- Occupation and Geography: The majority of patients were from rural areas (79.5%), with farmers (56.4%) and workers (28.2%) being the most common occupations.

- Medical History: Only 5.2% had a history of abdominal surgery. 23.1% had received prior treatment or intervention before the surgery.

- BMI and ASA: The average BMI was 19.29±2.61 kg/m², with 28.2% of patients being underweight. 97.4% were classified as ASA-1 or ASA-2.

3.2. Clinical features

- Functional Symptoms: Dysphagia and vomiting were present in 100% of patients, primarily occurring with every meal (61.5% for dysphagia, 43.6% for vomiting). Chest pain was reported by 82.1% (mostly occasional). Weight loss occurred in 89.7% (mostly < 10kg).

- Duration of Dysphagia: The median duration was 48 months (range 20-132 months), with 41% lasting for ≥60 months.

- Eckardt Score: The average score was 7.36±1.61 points (range 3-10), with 71.8% of patients in stage III. The median Eckardt score for the group with dysphagia lasting ≥5 years was significantly higher than the group with < 5 years (8.5 vs. 7.0, p=0.002).

- Heartburn: 35.9% had no or very few symptoms. The median score was 1 point.

- Extra-esophageal Symptoms: Nocturnal aspiration cough was present in 94.9%, chin-jut sign in 61.5%, and globus sensation in 25.6%.

- Preoperative Quality of Life (SF-36): The average score was 73.64±10.51 points. 53.8% were at a medium level, and 43.6% were at a high level.

3.3. Paraclinical characteristics

- Barium Swallow Esophagogram: 100% of patients showed the "bird-beak" sign and contrast retention. 79.5% had a straight esophagus, while 20.5% had a sigmoid-shaped esophagus. The average diameter was 4.34±1.64 cm. 43.6% had grade II dilation, and 15.4% had grade IV dilation. The longer the duration of dysphagia, the more severe the esophageal dilation ($p<0.05$).

- Esophagogastroduodenoscopy (EGD): The cardia was spastic in 84.6%, the esophagus was dilated in 79.5%, and there was retention in 71.8%. 58.9% had all three signs. 76.9% showed no structural lesions.

- Chest and Abdominal CT Scan: 89.7% of patients had a dilated esophagus, and 87.2% had a stenotic cardia. The average diameter was 4.32±1.78 cm.

- Plain Chest/Abdominal X-ray: 61.5% had an absent gastric air bubble. 89.7% had a normal chest X-ray.

- Blood Tests: 84.6% had normal hemoglobin levels, and 79.5% had normal albumin levels.

3.4. Results of laparoscopic Heller myotomy with with Dor fundoplication

3.4.1. Surgical results

- Myotomy Incision Length: The total average length was 8.22±0.45 cm. The esophageal myotomy above the Z-line was 5.89 cm, and the cardiac myotomy below the Z-line was 2.32 cm.

- Dor Fundoplication: The average length of fundus mobilization was 13.26±0.72 cm. 84.6% of cases used 8 stitches.

- Intraoperative Difficulties: 10.2% of patients experienced difficulties (adhesions due to fat, soft muscle).

- Catheter/Drain Placement Rate: Nasogastric tubes were retained in 7.7% of patients, and an abdominal drain was placed in 5.1%.

- Surgical Duration: The average surgical time was 118.21±23.21 minutes. 66.7% of surgeries were completed in ≤120 minutes. Intraoperative difficulties and complications significantly increased surgical time ($p<0.05$). Patients with grade I and III esophageal dilation had significantly longer surgical times ($p<0.05$).

- Intraoperative Complications: 10.3% of patients had complications (mucosal perforation 5.1%, pleural tear 2.6%, subcutaneous emphysema 2.6%). There were no deaths.

- Blood Loss: The average blood loss was 7.18±2.99 ml.

- Technical Success Rate: The technical success rate was 100%, with no conversions to open surgery.

3.4.2. Postoperative treatment results

- Recovery Time: The average time to pass flatus was 24.59±6.74 hours. The average time to resume oral feeding was 2.69±0.8 days.
- Length of Hospital Stay: The average hospital stay was 6.26±1.23 days. Intraoperative complications significantly increased the length of hospital stay (p=0.044).
- Pain Level: 94.9% of patients experienced mild pain (VAS score of 1-2). Paracetamol was the primary analgesic used (87.2%), with an average duration of use of 1.54±0.64 days.
- Antibiotics: 87.2% of patients received Metronidazole alone for an average of 6.26±1.23 days.
- Postoperative Complications: No complications or deaths were recorded.

3.4.3. Postoperative follow-up results

- Follow-up Duration: The average follow-up period was 27.21±13.50 months (range 6-53 months).
- Clinical Symptoms: Dysphagia decreased from 100% to 2.6% (at 1 month post-op), rising to 15.4% by the end of the study. Vomiting/regurgitation decreased from 100% to 0% (at 1 month post-op), with a slight increase to 5.1% by the end. Chest pain decreased from 82.1% to 5.1%. Weight loss decreased from 89.7% to 5.1%.

- Weight Change: The rate of weight gain post-surgery reached 82.1% after 1 month and was maintained at >83% by the study's conclusion. The average weight gain was 5.94±3.38 kg.

- Eckardt Score: The score dropped significantly from 7.36±1.61 pre-op to 0.33±0.54 (at 1 month) and remained low. 97.4% of patients were in stage 0 after 1 month.

- Heartburn: Heartburn symptoms were significantly reduced ($p<0.001$).

- Paraclinical Findings: The esophageal diameter on X-ray decreased ($p<0.001$). Endoscopy showed a significant reduction in the rates of esophageal dilation, retention, and cardia spasm. The rate of reflux esophagitis also decreased.

- Quality of Life (SF-36): All domains showed significant improvement ($p<0.05$). The average score increased from 73.64 to 85.93. 92.3% of patients achieved a high quality of life level.

- Patient Satisfaction: 97.4% of patients were satisfied to very satisfied.

- Symptom-free Survival: 2 patients (5.1%) experienced clinical recurrence after 3 and 36 months.

CHAPTER 4. DISCUSSION

4.1. Clinical and paraclinical characteristics and application of laparoscopic Heller myotomy with Dor fundoplication

4.1.1. General characteristics of research subjects

In this study, the average age of patients was 49.03, which is consistent with other research showing that the disease is most common between the ages of 30 and 60. Females constituted the majority (69.2%), which differs from some international studies with an equivalent male-to-female ratio. Most patients came from rural areas (79.5%) and were farmers or factory workers, suggesting a possible link to environmental factors, lifestyle, and limited access to healthcare.

A high percentage of patients (76.9%) had a history of gastritis, which made diagnosis difficult and led to delayed treatment. The low rate of patients who had received prior endoscopic intervention reflects the limited access to these procedures in Vietnam. The low average BMI (19.29 kg/m^2) reflects a state of malnutrition due to prolonged dysphagia. While most patients were in a low surgical risk group (ASA 1 and ASA 2), nutritional support and physical rehabilitation are necessary for malnourished cases before surgery.

4.1.2. Clinical features of achalasia

The study shows that dysphagia and vomiting were characteristic symptoms, present in 100% of patients. The median duration of dysphagia was 48 months, reflecting that patients presented late, often in advanced stages with a mean Eckardt score of 7.36. The longer the

disease duration, the more severe the symptoms, as shown by the significantly higher Eckardt score in the group with dysphagia for ≥5 years (p=0.002).

Chest pain was reported in 82.1% of patients, mostly occasionally. This rate is higher than in some other studies, which could be due to patients being in a more advanced stage and the symptom being easily confused with GERD or cardiovascular disease. Weight loss occurred in 89.7% of patients, mostly <10kg, reflecting the consequences of insufficient food intake and poor nutrition.

Heartburn was noted in 64.1% of patients, which is higher than some other studies. This could be because patients presented later in the disease course, leading to the accumulation of fermented fluids and easy misdiagnosis as GERD. Extra-esophageal symptoms such as nocturnal aspiration cough were the most common (94.9%), while the chin-jut sign (61.5%) was an important but often overlooked indicator.

4.1.3. Paraclinical characteristics of achalasia

For the diagnosis of achalasia, barium swallow esophagogram, esophagogastroduodenoscopy (EGD), and esophageal manometry are the three main, complementary techniques. However, high-resolution manometry (HRM) is not yet widely available in Vietnam, so diagnosis often relies on clinical symptoms, X-ray, and endoscopy.

The results of the barium swallow esophagogram showed that 100% of patients had the "bird-beak" sign and contrast retention. The average diameter was 4.34 cm, with a predominance of grade II and

grade IV dilation. 20.5% of cases had a sigmoid-shaped esophagus, which is associated with prolonged disease and surgical difficulty.

EGD revealed esophageal dilation in 79.5% of patients, retention in 71.8%, and cardia spasm in 84.6%. 58.9% had all three of these signs. Endoscopy also detected mucosal lesions such as inflammation (12.8%), ulcers (5.1%), and fungal infections (5.1%) due to prolonged retention. Notably, 5.1% of cases had a normal endoscopic appearance, confirming that endoscopy alone is not sufficient for diagnosis.

CT scan of the chest and abdomen showed that 89.7% of patients had esophageal dilation and 87.2% had cardiac stenosis, with an average diameter of 4.32 cm. CT is useful for distinguishing primary achalasia from secondary causes (tumors, compression). However, 10.3% of cases had a normal CT scan, indicating that it cannot be used as a standalone diagnostic tool.

4.1.4. Application of laparoscopic Heller myotomy with Dor fundoplication technique.

The laparoscopic Heller myotomy combined with Dor fundoplication technique involves 7 steps, similar to international studies. The main surgeon stands on the left side, the camera assistant is positioned between the patient's legs, and the surgical assistant is on the right, using 5 trocars. This setup offers the advantages of a wide surgical field, independent working space, a direct anatomical view, and optimal vision for the camera assistant. The technique of lifting and retracting the left lobe of the liver with a suspensory suture using

Vicryl 1/0 is simple, cost-effective, safe, and ensures a stable surgical field.

The extramucosal myotomy of the esophagogastric junction (Heller) is performed using an ultrasonic Harmonic scalpel guided by a Kelly clamp. The average total length of the myotomy incision was 8.22 cm, which is consistent with international recommendations (4-6 cm on the esophagus and 2-3 cm on the stomach). A sufficient incision length is crucial for achieving optimal relief from dysphagia. The Dor antireflux fundoplication is performed with two rows of sutures on both sides and sutures at the apex of the fundoplication fixed to the crus of the diaphragm, with additional stitches along the diaphragmatic pillars to prevent fibrous stenosis of the myotomy. The average length of mobilization of the greater curve of the fundus was 13.26 cm, and most cases used 8 stitches.

During the surgery, 10.2% of cases encountered difficulties (adherent fat, soft muscle). The complication rate was 10.3%, including mucosal perforation (5.1%), pleural tear (2.6%), and subcutaneous emphysema (2.6%). The mucosal perforation rate is comparable to the literature (3-33%). These complications did not lead to serious consequences because they were detected and managed in a timely manner. There were no conversions to open surgery or deaths. Intraoperative blood loss was minimal, averaging only 7.18 ml.

4.2. Results of laparoscopic Heller myotomy with Dor fundoplication

4.2.1. Surgical results

Regarding the use of catheters and drains, only 7.7% of patients had a nasogastric tube retained, and 5.1% had an abdominal drain placed (due to complications). This indicates that routine use is unnecessary. The average surgical time was 118.21 minutes, which is similar to other studies. Factors such as intraoperative difficulties, complications, and the degree of esophageal dilation significantly affected the surgical duration.

4.2.2. Postoperative treatment results

Patients recovered quickly after surgery. The average time to first flatus was 24.59 hours, and the average time to starting oral feeding was 2.69 days. Postoperative pain was mild in 94.9% of patients, requiring only Paracetamol. The average duration of analgesic use was 1.54 days. Antibiotics were mainly Metronidazole alone or in combination, with an average duration of 6.26 days. The average length of hospital stay was 6.26 days, and intraoperative complications had a significant impact on this duration ($p=0.044$). Notably, no postoperative complications or deaths were recorded.

4.2.3. Postoperative follow-up results

The average follow-up period for this study was 27.21 months. The rate of clinical recurrence was kept at a low level, with only 2 patients (5.1%) experiencing a recurrence after 3 and 36 months. This recurrence rate is consistent with other studies, and when recurrence occurs, pneumatic dilation is an effective solution.

Clinical symptoms such as dysphagia, vomiting, and chest pain were significantly reduced after surgery. The rate of weight loss

decreased, and a high rate of weight gain (>82%) was maintained postoperatively. The Eckardt score dropped sharply from 7.36 pre-op to 0.33 after 1 month and remained at a low level, with 97.4% of patients in stage 0 after 1 month. Heartburn symptoms were also markedly reduced ($p<0.001$).

Regarding paraclinical findings, the esophageal diameter on X-ray decreased significantly ($p<0.001$). Endoscopy showed a clear reduction in the rates of esophageal dilation, retention, and cardia spasm. The rate of reflux esophagitis also decreased. The patients' quality of life, assessed using the SF-36 scale, improved significantly in all domains ($p<0.05$), with the average score increasing from 73.64 to 85.93. 92.3% of patients achieved a high quality of life level. Patient satisfaction with the treatment results was very high (97.4% were satisfied to very satisfied).

CONCLUSION

1. Clinical and paraclinical characteristics and techniques laparoscopic Heller myotomy with Dor fundoplication for Achalasia

The patient group had a mean age of 49.03 ± 16.66 years, with a majority being female (69.2%). The condition was most common in the working-age population between 20 and 60.

The prominent clinical symptoms were dysphagia, regurgitation, chest pain, and weight loss. The mean preoperative Eckardt score was 7.36 ± 1.61, indicating severe symptoms, with 71.8% of patients having a score > 6. The median duration of dysphagia was 48 months, reflecting the reality of delayed diagnosis and treatment.

The mean esophageal diameter on X-ray was 4.34 ± 1.64 cm, with 20.5% of cases showing a sigmoid shape and 43.6% having Grade II esophageal dilation. The longer the duration of dysphagia, the wider the esophagus tended to become.

Flexible esophagogastroduodenoscopy also revealed classic signs such as esophageal dilation (79.5%), food retention (71.8%), and a spastic cardia (84.6%). A CT scan detected an enlarged esophagus in 89.7% of patients and a stenotic cardia in 87.2%, confirming the important role of endoscopy and CT in diagnosing the disease.

Laparoscopic Heller myotomy with Dor anti-reflux fundoplication, performed in a 7-step process with the surgeon standing on the left and using 5 trocars, is a convenient and effective technique for treating achalasia.

2. Results of laparoscopic Heller myotomy with Dor fundoplication for achalasia at Nghe An General Friendship Hospital

The surgical technique proved highly feasible with a mean esophagogastric myotomy length of 8.22 ± 0.45 cm, an average surgical time of 118.21 ± 23.21 minutes, and minimal blood loss, averaging only 7.18 ± 2.99 ml. The rate of intraoperative complications was low at 10.3%, with the majority being mucosal perforations (5.1%). There were no severe postoperative complications or deaths, confirming the safety of the surgical method.

Most patients recovered quickly, with 92.3% not requiring a nasogastric tube and 94.9% not needing an abdominal drain. Mild postoperative pain (94.9%) and a short duration of painkiller use (mean of 1.54 days) contributed to a short time to first flatus (mean of 24.59 ± 6.74 hours) and oral feeding (mean of 2.69 ± 0.8 days). The mean hospital stay was 6.26 ± 1.23 days, and intraoperative complications significantly affected this duration ($p<0.05$).

With a mean follow-up of 27.21 ± 13.5 months, the clinical recurrence rate was low (5.1%). The patients' quality of life, assessed using the SF-36 scale, improved significantly after surgery, with 92.3% reporting a high quality of life and 7.7% reporting a medium level. Patient satisfaction with the treatment outcome was very high, with 97.4% being satisfied to very satisfied.

RECOMMENDATION

Our study of 39 patients with achalasia who underwent laparoscopic Heller myotomy with Dor fundoplication demonstrates that this technique is a durable, safe, and highly effective intervention. It was found to significantly improve symptoms and enhance the quality of life, leading us to recommend it as the primary surgical choice for eligible patients at the provincial and regional hospital.