Al-Rafidain J Med Sci. 2026;10(2):242-247.
DOI: https://doi.org/10.54133/ajms.v10i2.2949

AJMS

Online ISSN (3219-2789)

Research Article

Laparoscopic Heller's Myotomy for Achalasia Cardia: An Outcome and Experience of a Single-Center Study

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Received: 26 March 2026; Revised: 8 May 2026; Accepted: 12 May 2026

Abstract

Background: Achalasia cardia is a rare disease mostly caused by myenteric plexus degeneration. The main clinical presentations are dysphagia, regurgitation, chest pain, and weight loss. ***Objectives***: This study aimed to evaluate the feasibility and outcome of laparoscopic Heller's myotomy. ***Methods***: This is a prospective study involving 52 patients with achalasia diagnosed by OGD, barium swallow, and esophageal manometry. All patients underwent laparoscopic surgery. ***Results***: This study includes 23 males and 29 females with a male/female ratio of 1.26. The mean age of patients was 36.8 years. The mean operative time was 85.12 minutes, with a mean hospital stay of 4.27 days. All patients had undergone laparoscopic Heller's myotomy with Dor fundoplication; there were no conversions to open surgery. Intraoperatively detected complications involve 4 patients with esophageal mucosal injury, 1 patient with gastric mucosal injury, and 2 patients with minute pleural injury and no significant intraoperative bleeding, adjacent organ injury, or surgical emphysema. Regarding the early postoperative complications, 3 patients (5.76%) had atelectasis, 1 patient (1.92%) had pneumonia, and 1 patient (1.92%) had a leak due to a missed esophageal mucosal injury discovered on the third postoperative day; 3 patients (5.88%) with mild dysphagia were successfully treated conservatively, and one patient (1.92%) died on the sixth postoperative day. About late complications, 4 patients (7.84%) developed mild GERD, and 1 patient developed recurrent dysphagia. ***Conclusions***: Laparoscopic Heller's myotomy is feasible and effective therapy for achalasia cardia. DOR fundoplication is a competent anti-reflux procedure to decrease the rate of postoperative GERD.

Keywords: Achalasia cardia; Dysphagia; Fundoplication; Hiller myotomy; Manometry.

تداخل شق هيلر العضلي بالمنظار لعلاج الكلازيا القلبية: نتيجة وتجربة دراسة من مركز واحد

الخلاصة

الخلفية: الكلازيا القلبية هي مرض نادر يسببه في الغالب تنكس الضفيرة العضلية. الأعراض السريرية الرئيسية هي عسر البلع، ارتجاع القيء، ألم الصدر، وفقدان الوزن. **الأهداف**: هدفت هذه الدراسة إلى تقييم إمكانية ونتائج عملية قص عضلة هيلر بالمنظار. **الطرق**: دراسة مستقبلية شملت 52 مريضا مصابين بالأكالازيا تم تشخيصهم بواسطة OGD، وبلع الباريوم، وقياس ضغط المريء. جميع المرضى خضعوا لجراحة بالمنظار. **النتائج**: تشمل هذه الدراسة 23 ذكرا و29 أنثى بنسبة ذكور إلى إناث تبلغ 1.26. كان متوسط عمر المرضى 36.8 سنة. كان متوسط وقت العملية 85.12 دقيقة، مع متوسط إقامة في المستشفى 4.27 يوما. جميع المرضى خضعوا لعملية عضلة هيلر بالمنظار مع عملية دور الفوندوبيليشن؛ لم تكن هناك تحويلات إلى جراحة مفتوحة. تشمل المضاعفات المكتشفة أثناء العملية 4 مرضى يعانون من إصابة في مخاط المريء، ومريضا واحدا يعاني من إصابة في الغشاء المعدي، ومريضين يعانون من إصابة جنبية دقيقة دون نزيف كبير أثناء العملية، أو إصابة في الأعضاء المجاورة، أو انتفاخ رئوي جراحي. فيما يتعلق بالمضاعفات المبكرة بعد العملية، كان لدى 3 مرضى (5.76٪) انخماع، ومريض واحد (1.92٪) لديه التهاب رئوي، ومريض واحد (1.92٪) كان لديه تسرب بسبب إصابة مخاطية مريئة مفقودة تم اكتشافها في اليوم الثالث بعد العملية؛ تم علاج 3 مرضى (5.88٪) يعانون من عسر بلع خفيف بنجاح بشكل تحفظي، وتوفي مريض واحد (1.92٪) في اليوم السادس بعد العملية. فيما يتعلق بالمضاعفات المتأخرة، أصيب 4 مرضى (7.84٪) بمرض ارتجاع خفيف، ومرض واحد أصيب بعسر بلع اللعلع المتكرر. **الاستنتاجات**: يعد استئصال عضلة هيلر بالمنظار علاجا ممكنا وفعالا للأكلازيا القلبية. يعد علاج DOR فندوبليكيشن التابع للعلاج الطبي الخفيف إجراء كاف لتقليل معدل ارتجاع المريء بعد العملية.

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Article citation: Jasim NH, Abdullah MA, Abdulkarim KS, Al-Hilfi AD. Laparoscopic Heller's Myotomy for Achalasia Cardia: An Outcome and Experience of a Single-Center Study. *Al-Rafidain J Med Sci.* 2026;10(2):242-247. doi: https://doi.org/10.54133/ajms.v10i2.2949

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INTRODUCTION

It is known that achalasia cardia is a rare condition that affects 1 in 100,000 people per year [1]. It is a primary motor disorder of the esophagus of uncertain etiology. Many studies considered it an autoimmune disease due to myenteric plexus degeneration [1]. However, other studies have attributed this disease to *Trypanosoma cruzi* infestation [2], which is common in South America; hence, recent studies show rising disease incidence [3]. It is reported that there is no sex or race difference [1]. The age distribution of this disease has two peaks: 20-40 or 60-70 years [4]. Dysphagia for solid and fluid diets, regurgitation, chest pain, and loss of weight are the classical symptoms [2]. The diagnosis of achalasia cardia is made through esophagogastroduodenoscopy (OGD), which reveals a dilated, a peristaltic upper part of the esophagus containing residues of undigested food, along with a constricted lower esophageal sphincter. A barium swallow reveals the characteristic "bird's beak" shape of the lower esophagus. Esophageal manometry confirms the diagnosis by showing absence of upper esophageal peristalsis with lack of lower esophageal sphincter relaxation while swallowing [5,6]. Treatment

of achalasia cardia includes different medical, endoscopic, and surgical modalities. Medical therapy involves calcium channel blockers, nitrates, and botulinum toxin injections [7]. The endoscopic approach includes balloon dilatation and peroral endoscopic myotomy (POEM) [7]. Surgical therapy includes Heller's myotomy, which can be achieved by transabdominal or transthoracic approaches and by open, laparoscopic, or robotic techniques [7-9]. The most common treatment is laparoscopic abdominal Heller's myotomy with partial fundoplication in the form of Dor or Toupet to reduce postoperative reflux [7-9]. However, subtotal esophagectomy could be spared for end-stage achalasia cardia (sigmoid achalasia) and after the failure of all other methods [10,11]. This study aimed to evaluate the feasibility and outcome of laparoscopic Heller's myotomy.

METHODS

Study design and setting

This prospective study was conducted in Basrah Gastroenterology and Hepatology Hospital from December 2021 till December 2025. It included 52 patients with type II achalasia cardia; all of them underwent laparoscopic Heller's myotomy with Dor fundoplication. The diagnosis was achieved by detailed history and examination and proved by OGD, barium swallow, or contrast-enhanced computerized tomography (CT) scan and confirmed by esophageal manometry. All patients were assessed for the risk of general anesthesia by cardiopulmonary assessment alongside blood investigations. A detailed explanation of surgical procedures and their possible complications or possibility of conversion to open surgery was explained to all patients. Surgical operations were done by different surgeons at the same level in our hospital.

Inclusion criteria

All patients who were diagnosed as having type II achalasia cardia based on esophageal manometric findings of esophageal aperistalsis with an elevated median integrated relaxation pressure (IRP) of more than 20 mmHg with more than 20% of swallows showing panesophageal pressurization consulted our hospital during the period of study, were fit for surgery, and accepted the consents were included in this study.

Exclusion criteria

Patients with comorbidities or coagulopathy were made unfit for general anesthesia and pneumoperitoneum, and pregnant ladies were excluded from the current study.

Interventions and outcome measurements

Regarding the laparoscopic technique, the patient was positioned in the French position, with the surgeon standing between the patient's legs. Pneumoperitoneum was achieved using a closed method with a Veress needle to create an intra-abdominal pressure of 12-14 mmHg. Type, number, and position of ports: Five ports were inserted in the upper abdomen as follows: the first 10 mm port was placed at the junction of the lower one-third and upper two-thirds between the umbilicus and xiphisternum, slightly to the left. The other 4 ports: the 5 mm port was inserted in the right midclavicular line, the 12 mm port was inserted in the corresponding left midclavicular line, the 5 mm port was inserted in the sub-xiphoid area, and the 5 mm port was inserted in the left anterior axillary line.

Laparoscopic procedure

The right diaphragmatic crus was exposed by dissecting the vascular part of the lesser omentum above the hepatic branch of the vagus nerve. Then, the gastroesophageal junction was identified, and the left diaphragmatic crus was exposed, thus freeing the esophagus for almost 8 cm of the lower esophagus. Afterward, the anterior and posterior vagus nerves were properly identified and preserved. Subsequently, the muscle layers of the esophagus and stomach were incised (myotomy) 6-7 cm upward on the esophageal wall and 2-3 cm downward on the gastric wall using both sharp and blunt dissection techniques to avoid mucosal perforation. Eventually, fundoplication in terms of anterior Dor fundoplication was performed to avoid gastroesophageal reflux as in Figure 1A.

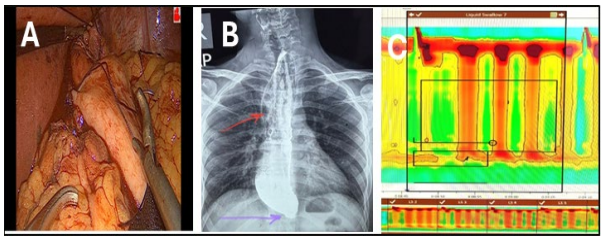

Figure 1: **A**) Dor Fundoplication after Heller' myotomy; **B**) Barium Swallow shows bird Peak appearance (blue arrow) and dilated esophagus (red arrow); **C**) Manometric picture of Type II achalasia configuration.

Postoperative care and follow-up

In the surgical ward, all patients received intravenous fluid, broad-spectrum antibiotics such as ceftriaxone 1 gm two times daily, and analgesia with close monitoring to detect serious complications like bleeding (tube drain observation, pallor, port site dressing inspection, and vital signs); leak (temperature elevation, severe abdominal pain, and vital signs, particularly pulse rate); and respiratory complications like atelectasis and pneumonia (cough, dyspnea, low-grade fever, respiratory rate, and SpO_2). All patients began pure fluid oral intake after 18-24 hours, except for those with intraoperatively detected and sutured mucosal injuries, who were permitted to start pure oral fluid intake only after a gastrografin water-soluble test 2 days postoperatively to confirm the absence of a leak; the tube drain was then removed 3-4 days postoperatively. Follow-up was scheduled as follows: after 1 week for stitch removal and patients' checkups to detect any possible early complications, like difficulty swallowing and reflux symptoms or respiratory complications. Then, for patients with mild

dysphagia or symptoms of gastroesophageal reflux disease (GERD), follow-up appointments were scheduled every month for 3 months. If patients were well on the first visit, then the second visit was after three months. Consequently, the third visit was after 6 months; patients were clinically assessed and endoscopically evaluated for patients with dysphagia or reflux symptoms (GERD). Then, the fourth visit was after 1 year for progressive recurrent dysphagia, which was represented by significant dysphagia that was confirmed by bird-peak appearance using a barium study with endoscopic findings of achalasia-like dilated upper esophagus with food residue and a tight lower esophageal sphincter.

Ethical considerations

The study protocol was approved by the Ethics Committee of Basrah College of Medicine, Basrah, Iraq. All participants provided written informed consent. The study adhered to the Declaration of Helsinki.

Statistical analysis

Statistical analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 26. Qualitative data were presented in terms of number and percentage, while quantitative data were presented in terms of mean ± SD.

RESULTS

The current study included 52 patients. There were 23 males and 29 females, with a male/female ratio equal to 1:1.26. Their ages ranged from 11 years to 69 years, with the mean age being 36.8 ± 20.05 years, as shown in Table 1. Presentation of patients was dysphagia in 52 patients (100%), weight loss in 39 patients (75%), regurgitation in 33 patients (63.5%), and chest pain in 21 patients (40.4%), as shown in Table 1.

Table 1: Patient's characteristics

Parameters		Result
Male		23(44.23)
Female		29(55.76)
Male/Female ratio		1.0/1.26
Age (year)		36.8±20.05 (11-69)
LES Pressure (mmHg)		48±9.56 (46-65)
Dilatation (pneumatic balloon pre- surgery		5.0(9.6)
Main symptoms	Dysphagia	52(100)
	Regurgitation	33(63.5)
	Weight loss	39(75)
	Chest pain	21(40.4)

Values are presented as frequency, percentage, and mean±SD.

In the current study, achalasia cardia was diagnosed by different tools; a barium swallow study was performed in 34 patients (65.38%), showing a bird's beak appearance as shown in Figure 1B. Chest and upper abdominal contrast-enhanced CT scans were done for 17 patients (32.69%) to exclude malignancies leading to pseudo-achalasia. However, all 52 patients (100%) were examined by OGD, showing a dilated esophagus with a tight lower esophageal sphincter (LES). Esophageal manometry was done for all patients (100%) inside our hospital, and the diagnosis was confirmed as illustrated in Figure 1C. The mean of LES pressure by manometry was 48±9.5 mmHg with an average of 46-65 mmHg. There were 5 patients (9.6%) who had undergone unsatisfactory pneumatic balloon dilatation. Hence, they accepted undergoing laparoscopic Heller's myotomy for variable durations after balloon dilatation. Table 2 shows that the operative time ranged from 75 to 150 minutes, with a mean of 85.12 ± 16.62 minutes.

Table 2: Operative time, hospital stay and intraoperative complications

Parameters		Result
Operative time (min)		85.12±16.62 (75-150)
Hospital stays (day)		4.27±1.03 (3.0-6.0)
Type of procedure	Laparoscopic Heller with Dor	52(100)
	Laparoscopic Heller with Toupet	0(0.0)
	Conversion to open surgery	0(0.0)
Intraoperative complications	Esophageal mucosal perforation	4 (7.69)
	Gastric mucosal perforation	1(1.92)
	Bleeding	0(0.0)
	Surgical emphysema	0(0.0)
	Pleural injury	2(3.84)
	Significant adjacent organ injury	0(0.0)
	Vagus nerve injury	0(0.0)
	Total	7(13.46)
Conversion to open Surgery		0(0.0)

Values are presented as frequency, percentage, and mean±SD.

All patients (100%) underwent laparoscopic Heller's myotomy, accompanied by Dor, as shown in Figure 1A, but not Toupet fundoplication without conversion to open surgery. The range of hospital stays was 3-6 days with a mean of 4.27 ± 1.03 days. Intraoperative complications were reported in 7 patients out of a total of 52 (13.46%) involving the following: there were 4 patients (7.69%) with detected esophageal mucosal perforation, one patient (1.92%) with detected gastric mucosal perforation, and 2 patients (3.84%) with tiny insignificant pleural injuries that were managed by observation only with no intervention. However, there was no intraoperative bleeding, surgical emphysema, or adjacent organ injury as illustrated in Table 2. All cases of mucosal perforation were sutured immediately intraoperatively with Vicryl 3-0 sutures and tested by the methylene blue test to rule out the presence of a leak, and a tube drain was inserted for 3-4 days postoperatively. Regarding early postoperative complications, there were 3 patients (5.76%) with atelectasis and 1 patient with pneumonia (1.92%). All of them were successfully treated conservatively.

However, 1 patient died (mortality rate was 1.92%) after a missed leak, as shown in table 3. There were 3 patients out of 51 patients (after exclusion of dead patients) (5.88%) who developed mild dysphagia in the early postoperative period, which responded to supportive treatment, and instructed patients to eat a soft diet. All of them improved after 1-2 months as illustrated in Table 3. Regarding late complications in the current study, there were 4 patients (7.84%) with mild GERD (grade A-B according to the Los Angeles classification) proved by OGD 6 months postoperatively and successfully responded to PPI for 1 month. Additionally, one patient (1.96%) with recurrent dysphagia proved by barium swallow after 1 year was scheduled for redo surgery as demonstrated in Table 3.

Table 3: Postoperative complications

Variable		Result
Early complications	Atelectasis	3.0(5.76)
	Pneumonia	1.0(1.92)
	Surgical Emphysema	0(0.0)
	Intraoperative bleeding	0(0.0)
	Leakage followed by death	1.0(1.92)
	Mild dysphagia	3.0(5.88)
Late Complications	Mild GERD	4(7.84)
	Recurrence	1.0(1.96)

Values are presented as frequency and percentage.

DISCUSSION

Achalasia cardia is an uncommon disease. Typically, the main presentations are difficulty swallowing both solids and fluids, regurgitation, weight loss, and chest pain **[**7,12,13**].** Our patients have demonstrated these presentations. Generally, in most patients, there is a delay in diagnosis because the disease progression is slow and the main clinical features are frequently similar to those of GERD or slight dysphagia, confusing the diagnosis for a few year**s [**7,12,13**].** The availability of various diagnostic tools in our specialized hospital might accelerate the diagnosis and reduce the delay period. The diagnostic tools include an esophagogastric-duodenoscope (OGD), which demonstrates dilatation of the aperistaltic upper part of the esophagus with the presence of food particles and stenosis of the lower esophageal sphincter (LES). However, the diagnostic sensitivity of OGD per se is relatively low, and it is reported that around 35% of patients are correctly diagnosed by OGD [5]. But it is very important to exclude malignant growth in the lower esophagus and upper stomach and raise the suspicion of achalasia cardia, which will be confirmed by further investigations [5]. Furthermore, a barium swallow study can diagnose achalasia cardia by showing the characteristic finding of a 'bird's beak appearance' accompanied by delayed emptying of barium sulfate. Timed barium esophagogram (TBE) is a simple, dependable, straightforward, low-cost technique; additionally, it supplies an objectively assessed esophageal emptying status. This test can be used in the diagnosis of achalasia alongside follow-up after therapy [15]. Moreover, a computerized tomography (CT) scan of the chest and upper abdomen can exclude secondary achalasia cardia by excluding a malignant tumor involving the lower esophagus, gastroesophageal junction, or stomach, besides detecting lymph node involvement by tumor or distant hepatic, pulmonary, or bony metastasis reflecting secondary achalasia [16]. High-resolution manometry (HRM) (Insight Ultima manometry system, Diversatek HealthCare, USA) is essential in the diagnosis and confirmation of achalasia cardia and its variable subtypes. Far-reaching utilization of esophageal manometry leading to early recognition of achalasia cardia. It demonstrates lack of peristalsis of the esophagus and defective relaxation of the LES in swallowing [17]. In the current study, a barium swallow study was performed in around two thirds of our patients, and a chest and upper abdominal contrast CT scan was done for around one third of patients. However, all our patients were examined by OGD, and esophageal manometry was done for 90% of patients to confirm the diagnosis. Achalasia cardia is attributed to degeneration of the myenteric plexus [18]; hence, all therapeutic modalities target symptomatic relief, particularly dysphagia, without reversal of the causative neurological disorder [10,19]. The pneumatic balloon dilatation procedure has a poor long-term outcome and necessitates frequent repetition [20]. POEM is a rising approach requiring an escalating learning curve of training by endoscopists. But it carries a high likelihood of GERD because it has not been accompanied by an anti-reflux procedure and, thus, a possibility of late progression to Barrett's esophagus [7]. In the current study, there were 5 patients exposed to balloon dilatation and accepted laparoscopic Heller myotomy due to the unsatisfactory outcome of balloon dilatation. No patients in our study had undergone POEM prior to laparoscopic Heller myotomy, which is considered the standard procedure for achalasia cardia therapy [7,21]. Laparoscopic Heller myotomy carries many advantages over Heller 's laparotomy or thoracotomy in terms of less pain postoperatively and, thus, presumably, less time spent in the hospital. Additionally, the surgical field is better visualized, and, hence, main structures are much better identified, like the gastroesophageal junction, left and right crura, vessels, and Vagus nerves. Furthermore, tiny mucosal perforations can be easily recognized [19,22]. Therefore, laparoscopic Heller was chosen and adopted in our work. Regarding fundoplication for reflux control. The debate whether a complete or partial wrap was hypothetically sorted out by the exclusion of a complete wrap (Nissen fundoplication) due to a reported high rate of postoperative dysphagia [10,19]. Partial anterior 180° fundoplication (Dor) is simpler from a technical point of view in comparison with posterior 270° fundoplication (Toupet). Consequently, it takes less dissection in the posterior mediastinum and thus a shorter operative duration. Additionally, the wrap works as a protective patch above the exposed mucosa after myotomy and, presumably, decreases the risk of leaks from minute missed mucosal perforations during the operation. Hence, this type of fundoplication was implemented for patients in our study. However, this type of fundoplication is blamed for early temporary postoperative dysphagia due to edema or hematoma at

the site of the mucosa-wrap area [19,23]. On the other hand, Toupet fundoplication has the advantage of keeping two edges of the myotomy apart and not closed by suturing them separately to the wrapped gastric fundus. Furthermore, it is reported that Toupet has more control for reflux postoperatively [7,23]. In the current study, the mean operative time was 85 minutes, which is nearly compatible with the results of Kaman *et al.,* which are 93.3 minutes [13], and less than the results of Agrawal et al., which are 112 minutes [7]. In our study, there were no conversions to open surgery, and this finding is compatible with the results of others [7,13] and the mean hospital stay was 4.27 days, which is nearly comparable to the other reports [7,13]. In the current study, the most common intraoperative complication was mucosal perforation, which occurred in 6 patients (including 4 mucosal esophageal perforations detected during surgery, 1 missed mucosal esophageal perforation, and 1 gastric mucosal perforation detected during surgery), representing 11.53%. This rate is approximately consistent with the 12% perforation rate reported by Kaman et al. [13]. Additionally, Agrawal *et al.* reported mucosal perforation in 1 patient out of 10 patients in their case series, representing 10% [7], but it should be considered cautiously because of their small cohort, leading to limited statistical strength. In the current study, all intraoperatively detected mucosal perforations were immediately sutured with Vicryl 3-0 and then tested to rule out leaks by methylene blue dye, alongside keeping the tube drain for 4-5 days. In the current study, there was no Vagus nerve injury. Additionally, there were 2 cases of tiny iatrogenic pleural injury recognized intraoperatively, which necessitated no treatment. These results come in accord with other studies done by many other researchers regarding Vagus nerve injury and, in contrast, regarding pleural injury, showing neither Vagus nerve injury nor pleural injury in their reports [7,13,24]. Regarding early postoperative complications, there was 1 intraoperatively missed mucosal perforation that was suspected clinically on the third postoperative day due to a rise in temperature, pulse rate, and respiratory rate and confirmed by a gastrografin water-soluble test on the same day, demonstrating a clear leak. The abdomen was explored by laparoscopy, and peritoneal lavage was first done using a normal saline solution, and the perforated mucosa was repaired using simple suturing with a Vicryl 3-0 suture, accompanied by the use of a feeding jejunostomy tube and a tube drain. In spite of that, the patient died on the sixth postoperative day due to mediastinitis and its consequences. Therefore, the mortality rate in our study was 1.92%. Many other studies conducted by Agrawal et al., Kaman *et al*., and Gülpınar *et al*. report that there are no deaths among their patients [7,13,24]. Regarding improvement of symptoms after surgery in the current study and following the exclusion of 1 dead patient, there were 47 patients out of 51 (92.15%) who improved concerning dysphagia from the start, and 3 patients out of 51 (5.88%) developed mild dysphagia. They responded well to advice to patients to eat a soft diet during the first 1-2 months. This phenomenon could be attributed to mucosa-anterior wrap edema or inflammation, which subsided with time. This finding is compatible with the results of studies conducted by Kaman et al. and Gülpınar et al. [13,24]. And 1 patient developed significant dysphagia, proved after 1 year as recurrent achalasia by barium study and esophageal manometry. The recurrence is generally attributed either to inadequate myotomy or to more progressive neurological degeneration. In contrast, many other studies have not reported any recurrence [7,13,24]. Post-operative GERD occurred in 4 out of 51 patients (7.84%), and the condition was classified as mild GERD grade A-B, which is comparable to the results of a study conducted by Kamil et al., who reported that 7.5% of their patients developed post-operative GERD [24]. All our patients responded well to proton pump inhibitors.

Study Limitations

Performing only one type of fundoplication limited the comparison with other types of fundoplication to obtain a statistically significant clinical decision about the type of fundoplication that might affect postoperative dysphagia and postoperative GERD. Additionally, a relatively short average follow-up period for some cases might restrict detecting recurrent cases.

Conclusion

Laparoscopic Heller's myotomy is a feasible and effective therapeutic modality with a high rate of patients' improvement and safety. DOR fundoplication offers a high rate of reflux control, demonstrating both high competency and simplicity, while also maintaining a low incidence of postoperative dysphagia.

ACKNOWLEDGMENTS

The authors thank all patients who agreed to participate in this study.

Conflict of interests

The authors declared no conflict of interest.

Funding source

The authors did not receive any source of funds.

Data sharing statement

Supplementary datasets used and/or analyzed during the current study are available from the corresponding author based on a reasonable request.

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