

Review Article

Surgical and endoscopic approaches to achalasia: what does the evidence say

Salvador Zadur Kaloyan Lopez, Carlos Israel Verdugo Salazar*,
Luis Fernando Gálvez Coutiño, Casandra Rosas Rios

Unidad Medica de Alta Especialidad, del IMSS, Monterrey Nuevo León, Mexico

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*Correspondence:

Dr. Carlos Israel Verdugo Salazar,

E-mail: cv245997@gmail.com

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ABSTRACT

Achalasia is a rare primary esophageal motility disorder characterized by failure of the lower esophageal sphincter (LES) to relax and absence of normal peristalsis in the esophagus. Patients typically present with progressive dysphagia to both solids and liquids, regurgitation, chest pain, and weight loss. Diagnosis is confirmed by high-resolution manometry demonstrating incomplete LES relaxation and aperistalsis, with supportive findings on barium esophagram (e.g. “bird’s beak” narrowing) and endoscopy to exclude pseudo achalasia. Achalasia is subdivided into three manometric subtypes (I–III) based on esophageal pressure patterns, which have prognostic significance. Treatment is directed at relieving the distal esophageal obstruction, with options including pneumatic balloon dilation, laparoscopic Heller myotomy (LHM) with partial fundoplication, and peroral endoscopic myotomy (POEM). Botulinum toxin injection is reserved for high-risk patients. Current evidence from guidelines and recent studies indicates that LHM and pneumatic dilation have comparable efficacy in appropriate candidates, and POEM offers similar symptomatic relief to LHM. Manometric subtype guides therapy—type II achalasia responds best to any therapy, whereas type III often benefits from a tailored myotomy approach. The addition of fundoplication to Heller myotomy significantly reduces post-treatment reflux without compromising achalasia symptom control. In pediatric achalasia, Heller myotomy yields superior long-term outcomes compared to dilations. Robotic-assisted Heller myotomy is an emerging technique showing comparable efficacy to LHM with a potential reduction in perforation risk. An individualized, patient-centered approach - considering achalasia subtype, patient age/comorbidity, and available expertise is essential to optimize outcomes. This review synthesizes the current evidence on achalasia management, highlighting the role of Heller myotomy relative to other therapies in light of recent clinical guidelines and studies.

Keywords: Achalasia, Heller myotomy, Esophageal motility, Pneumatic dilation, POEM, Fundoplication, Manometric subtypes, Gastroesophageal reflux

INTRODUCTION

Achalasia is a chronic idiopathic disorder of esophageal motility characterized by impaired relaxation of the lower esophageal sphincter (LES) and absence of normal peristalsis in the esophageal body.^{1,2} Patients most commonly present with dysphagia to both solids and liquids, often accompanied by regurgitation of undigested food or saliva, retrosternal chest pain, and weight loss.¹

Because these symptoms can overlap with gastroesophageal reflux disease (GERD), achalasia is sometimes initially misdiagnosed, a lack of response to acid-suppressive therapy should raise suspicion for achalasia and prompt further evaluation.¹ The diagnostic workup of suspected achalasia includes a barium swallow, endoscopy, and esophageal manometry. A barium esophagram classically reveals a dilated, a peristaltic esophagus tapering to a “bird’s beak”

narrowing at the LES, reflecting distal obstruction.¹ Upper endoscopy is generally unremarkable aside from residual food or saliva in the esophagus, but is an essential step to exclude mechanical obstruction or malignancy at the gastroesophageal junction (so-called pseudo achalasia).¹ The definitive diagnostic test is high-resolution esophageal manometry, which demonstrates an elevated integrated relaxation pressure (incomplete LES relaxation) in conjunction with failed peristalsis; this finding is the manometric hallmark of achalasia and is the gold standard for diagnosis.² High-resolution manometry has also allowed classification of achalasia into three subtypes based on esophageal pressurization patterns, which has important therapeutic implications (discussed below).^{1,2}

Treatment of achalasia is aimed at relieving the functional obstruction at the LES, since the underlying neuromuscular degeneration cannot yet be reversed. The major treatment options are.

Pneumatic dilation

Forceful inflation of a balloon across the LES to disrupt the muscle fibers.

Heller myotomy

Surgical division of the LES muscle, now typically performed laparoscopically and accompanied by a partial fundoplication to prevent reflux.

Peroral endoscopic myotomy

A less invasive endoscopic tunneling technique to perform an internal myotomy of the LES.² Each of these approaches can alleviate dysphagia and improve esophageal emptying. A fourth therapy is botulinum toxin injection into the LES during endoscopy, which causes temporary paralysis of the sphincter muscle. Botulinum toxin can relieve symptoms in the short term but tends to wear off within months; current guidelines therefore reserve it for patients who are poor candidates for the more definitive therapies (dilation or myotomy) due to advanced age or comorbidities.¹

While Heller myotomy has long been considered the gold-standard treatment for achalasia, less invasive approaches (pneumatic dilation and peroral endoscopic myotomy (POEM)) have also proven highly effective. This raises the question of which therapy is optimal for a given patient. Recent clinical guidelines and studies have sought to compare outcomes of these treatments and to identify factors (such as manometric subtype or patient age) that can inform personalized management. In this article, we review the current evidence regarding achalasia management, with a focus on how Heller myotomy compares to alternative treatments (endoscopic and pharmacologic) in terms of efficacy, safety, and long-term results.

THEORETICAL FRAMEWORK

Pathophysiology and Classification: Achalasia is thought to result from an idiopathic degeneration of the inhibitory neurons in the esophageal myenteric plexus, leading to an imbalance favoring excitatory tone in the LES and failure of sphincter relaxation.² The loss of peristalsis in the esophageal body is due to deranged neural signaling in the esophagus. The Chicago Classification of esophageal motility disorders (version 3.0) defines three subtypes of achalasia based on high-resolution manometry patterns in the esophageal body.^{4,5}

Type I (classic achalasia) is characterized by minimal contractile activity or pressurization in the esophagus; essentially, there are no significant peristaltic or pan-esophageal pressure waves generated.

Type II achalasia features pan-esophageal pressurization when swallowing, the esophagus exhibits a synchronous pressurization (due to compression of retained contents) rather than an organized peristaltic wave.

Type III achalasia (spastic achalasia) is distinguished by spastic or premature contractions in the distal esophagus in addition to the impaired LES relaxation. These subtypes are not merely of academic interest; they have been shown to correlate with clinical outcomes. Notably, patients with type II achalasia have the best treatment responses. In a large prospective study, type II achalasia patients had significantly higher success rates (~96% symptom relief at 2 years) compared to type I (~81%) or type III (~66%) patients, regardless of treatment modality. Conversely, type III achalasia tends to be the most treatment-refractory subtype, often requiring repeated interventions; in the cited study, type III patients had a hazard ratio of ~6.8 for treatment failure compared to type II.⁵ Type III achalasia is also frequently associated with prominent chest pain, presumably due to spastic contractions, and this symptom has been linked to lower therapeutic success.⁵ Thus, achalasia subtyping provides a conceptual framework for anticipating response to therapy and tailoring the treatment approach.

Diagnostic evaluation

The confirmation of achalasia and determination of subtype rely on high-resolution manometry, as described above. However, other diagnostic measures play supporting roles. The timed barium esophagram (TBE) is a useful functional test: the patient swallows a fixed volume of barium and radiographs at 1, 2, and 5 minutes assess esophageal emptying. A TBE can quantify esophageal retention (height of barium column) and is often used to monitor treatment outcomes or detect failure (persistent stasis).¹ Endoscopy is indispensable to exclude other causes of esophageal outlet obstruction, such as a malignancy at the gastroesophageal junction; features suggestive of achalasia on endoscopy include a narrow, “puckered” gastroesophageal junction and

retained saliva or food in the esophagus.¹ Clinical symptom assessment is also important both in initial evaluation and post-therapy follow-up. The Eckardt score is a commonly used symptom scoring system for achalasia, incorporating weight loss, dysphagia, chest pain, and regurgitation, each graded 0–3 (where higher scores indicate more severe symptoms). A total Eckardt score ≤ 3 is often defined as clinical remission of

achalasia symptoms.⁴ This score and other patient-reported outcome measures help gauge the success of therapy over time. In summary, the diagnostic framework for achalasia involves combining objective measurements (manometry, imaging) with symptom assessment to guide management decisions and to stratify patients by disease subtype and severity.

Table 1: Comparison of achalasia treatments.

Aspect	Heller myotomy (+fundoplication)	POEM	Pneumatic dilation
Therapeutic modality	Surgical myotomy of LES + partial fundoplication	Endoscopic myotomy of LES	Forceful balloon inflation to disrupt LES
Main objective	Permanent disruption of LES obstruction and prevention of reflux	Permanent disruption of LES obstruction	Stretch LES fibers to reduce pressure
Symptom relief (short-term)	85–95%	85–95%	70–90%
Symptom relief (long-term)	Stable at 5–10 years	Stable at 2–5 years (ongoing data)	Lower at 5–10 years
GERD risk post-treatment	Low (with fundoplication)	High (up to 40–50%)	Low
Recommended for type III achalasia	Yes (preferable to dilation)	Yes (can extend myotomy length)	No (less effective in type III)
Need for repeat intervention	Low (~10% at 5 years)	Low–Moderate (~10–20%)	High (~25–50% require re-dilation)
Invasiveness	Minimally invasive (laparoscopic or robotic)	Minimally invasive (endoscopic)	Minimally invasive (endoscopic)
Postoperative recovery time	1–3 days hospital stays	1–2 days hospital stays	Same-day or 1-day stay
Typical adverse events	Mucosal perforation (~2%), rare complications	Capnoperitoneum, mediastinal emphysema	Perforation risk (~2–5%), transient chest pain

DISCUSSION

Comparative efficacy of heller myotomy, pneumatic dilation, and POEM

For the majority of adult achalasia patients, the first-line definitive therapies are pneumatic dilation (PD) or Heller myotomy, and these two interventions have been shown to have roughly equivalent efficacy in experienced hands. Randomized trials and long-term follow-up studies (including the European Achalasia Trial) have demonstrated comparable success rates for PD and surgical myotomy, especially over short- to medium-term follow-up.^{1,5} The American College of Gastroenterology (ACG) guideline concludes that PD and laparoscopic Heller myotomy (LHM) are both effective and yield similar symptomatic relief in both the short and long term.¹ At 2-year follow-up, success rates between these modalities do not significantly differ, and even at 5 years the outcomes remain equivalent when periodic re-dilation is used as needed for PD failures. Thus, both PD and Heller myotomy are endorsed as effective options for appropriately selected patients with achalasia.^{1,2}

The introduction of POEM in the last decade has added a third definitive treatment modality. Growing evidence, including meta-analyses and comparative studies, indicates that POEM achieves symptom control on par with LHM. According to the ACG and American Society for Gastrointestinal Endoscopy (ASGE) guidelines, POEM offers comparable symptomatic improvement to Heller myotomy in achalasia.^{1,2} For example, an analysis cited by the ACG guideline (encompassing >1,500 POEM patients and >2,500 LHM patients) found no difference in short-term success between POEM and laparoscopic Heller myotomy.¹

Likewise, a recent single-center study focused on type I achalasia reported nearly equivalent 3-year success rates of 83% after LHM (with Dor fundoplication) and 87% after POEM.⁴ Taken together, these data affirm that when it comes to relieving dysphagia and improving esophageal emptying, all three modalities—pneumatic dilation, surgical myotomy, and POEM—can be highly effective, with no clearly superior approach in general. This has shifted management toward a personalized strategy, weighing factors such as patient age, achalasia subtype, and risk tolerance, rather than a one-size-fits-all paradigm.

GERD and the role of fundoplication

Although the primary efficacy of Heller myotomy and POEM are similar, a critical difference lies in their side effect profiles, particularly the risk of iatrogenic gastroesophageal reflux. Laparoscopic Heller myotomy is routinely accompanied by a partial fundoplication (most often a Dor anterior fundoplication) to minimize postoperative reflux. In contrast, POEM disrupts the LES without any anti-reflux procedure. Consequently, post-procedure reflux is considerably more frequent after POEM than after Heller myotomy. In one comparative series of type I achalasia patients, abnormal acid exposure on pH monitoring was documented in 45% of patients after POEM, versus only 10% after Heller myotomy with Dor fundoplication (a greater than four-fold difference).⁴

A similar trend was noted in a meta-analysis: distal esophageal acid exposure occurred in roughly 39% of patients after POEM, significantly higher than in those who underwent LHM with a fundoplication.¹ These findings underscore the importance of reflux management in achalasia therapy. The evolving role of fundoplication has been a subject of debate, especially for achalasia subtype I (with absent peristalsis). Some clinicians questioned whether adding a fundoplication in an aperistaltic esophagus might hinder esophageal emptying, potentially negating some benefit of the myotomy. However, current evidence allays this concern.

A 2024 study specifically examining type I achalasia outcomes found that Heller myotomy with Dor fundoplication achieved comparable long-term symptom relief, esophageal emptying on timed barium swallow, and reintervention rates as POEM (which has no fundoplication).⁴ In other words, the fundoplication did not impair achalasia symptom outcomes, while it clearly conferred protection against reflux. Consistently, the ACG guideline recommends performing a partial fundoplication with surgical myotomy, as trials have shown it significantly reduces post-myotomy GERD (relative risk of reflux ~0.11 compared to myotomy without fundoplication) without compromising dysphagia relief.¹

Therefore, current best practice favors incorporating a fundoplication during Heller myotomy. The balance of evidence indicates that the anti-reflux benefit is substantial and that a properly constructed partial wrap does not create undue obstruction even in an esophagus that lacks peristalsis. This has important implications when comparing POEM to Heller myotomy while their efficacy in reducing dysphagia may be equivalent, patients undergoing POEM should be counseled about the high likelihood of needing long-term acid-suppressive therapy and close monitoring for GERD, whereas those undergoing Heller myotomy (with a fundoplication) have a much lower risk of severe reflux.

Manometric subtype and tailored therapy

Achalasia subtype influences the choice and expected success of therapy. Patients with type II achalasia (the most common subtype) generally have excellent outcomes with any of the standard therapies (PD, LHM, or POEM), with success rates approaching 90–95% in clinical trials.⁵ In contrast, type III (spastic) achalasia is more challenging to treat with conventional approaches like PD. The spastic distal segment in type III often requires a longer myotomy to relieve all areas of high-pressure contraction. For this reason, expert guidelines advocate a tailored approach for type III achalasia—specifically, Heller myotomy or POEM is preferred over pneumatic dilation for these patients.¹ Both of these myotomy techniques can be extended sufficiently to cut the spastic muscle segments.

POEM, in particular, offers the flexibility of an extended myotomy that can even span into the gastric cardia more easily, which is advantageous for type III disease. Clinical outcome data support this approach: studies have shown that type III achalasia patients have significantly lower success with dilation (and often require multiple dilations or crossover to myotomy) compared to surgical or endoscopic myotomy.⁵ Accordingly, a “tailored” strategy is recommended—for example, a younger patient with type III achalasia might be steered toward POEM or LHM as a first-line therapy to maximize the chance of symptom resolution, whereas a patient with type II achalasia might reasonably choose any of the options based on other factors, since all are likely to do well.^{1,5}

Type I (classic) achalasia represents an intermediate situation; PD or myotomy are both effective, but some series suggest slightly lower remission rates than type II, so treatment choice may depend on patient-specific considerations. Overall, recognizing the manometric subtype helps set expectations and informs the discussion: for example, being frank that a type III patient may need a second intervention even after an initial myotomy (given their higher failure hazard) or that a type II patient is very likely to achieve good long-term relief with a single intervention of almost any modality.

Safety and complications

Each therapeutic approach for achalasia carries certain risks that must be balanced against its benefits. Pneumatic dilation is typically performed under sedation or light anesthesia and can often be done as an outpatient procedure, but it entails a risk of acute esophageal perforation due to the forceful stretching of the LES. The perforation rate with PD in experienced centers is on the order of 2–5% per procedure.² If a full-thickness perforation occurs, it is a serious complication usually necessitating emergency surgical repair.

Heller myotomy (LHM), performed under general anesthesia, is an intra-abdominal surgery, but minimally

invasive laparoscopic technique has reduced the morbidity compared to historical open surgery. In LHM, an inadvertent mucosal perforation (entering the esophageal lumen) can occur while cutting the muscle surgeons are vigilant for this and will repair it intraoperatively if detected. The incidence of mucosal perforation during Heller myotomy is relatively low (approximately 2% of cases in experienced hands) and, when immediately repaired, typically does not compromise the outcome.⁶⁻¹⁰

The overall serious complication rates for LHM are low and comparable to those of PD when performed by skilled practitioners. POEM, being an endoscopic procedure, avoids external incisions and has a quick recovery, but it is not without risks. Complications of POEM include capnoperitoneum (air insufflation causing abdominal compartment pressure), mediastinal emphysema or emphysematous complications, and rare esophageal perforation or bleeding a recent meta-analysis reported clinically significant perforation in roughly 2–3% of POEM cases, similar to surgery.² Thus, the invasiveness and immediate risks of dilation, POEM, and LHM are in a similar range, and operator experience is a key determinant of safety.

An emerging development in surgical technique is the adoption of robotic-assisted Heller myotomy (RHM). Robotic surgical systems provide enhanced three-dimensional visualization and articulating instruments that can facilitate precise dissection. It has been hypothesized that RHM may further reduce complications or improve outcomes compared to standard laparoscopy. A 2025 systematic review and meta-analysis compared RHM to LHM in achalasia across 14 studies (over 12,000 total patients).^{6,11-15} The analysis found no significant differences between robotic and laparoscopic myotomy in terms of operative time, blood loss, length of hospital stay, postoperative symptom relief, or need for re-intervention.⁶

Both techniques achieved equivalent functional outcomes and symptomatic improvement. However, one notable difference was a lower incidence of intraoperative esophageal perforation in the robotic myotomy group. The pooled rate of mucosal perforation was approximately 1.7% with RHM vs 2.1% with LHM, and RHM was associated with a significantly reduced risk of perforation (risk ratio ~0.3 in favor of RHM).⁶ This suggests that the robotic platform's technical advantages might translate into a safety benefit by allowing more controlled, stable movements during the myotomy.

Importantly, the authors cautioned that the data were derived mostly from non-randomized studies subject to selection bias (for example, surgeons might choose robotics for more complex cases or vice versa), and thus definitive superiority of one approach over the other could not be established.⁶ Nevertheless, as surgical technology evolves, robotic Heller myotomy appears to be a safe and effective alternative to laparoscopy, with at

least an equivalent efficacy and a potential reduction in certain complications. The choice may ultimately depend on surgeon expertise and resource availability, rather than a clear-cut clinical mandate.

Special considerations-patient factors

Individual patient characteristics often guide therapy selection in achalasia. Age and comorbidity play a significant role. An elderly patient with significant medical comorbidities may not tolerate surgery well; in such cases, a strategy of less invasive management is reasonable. Repeated pneumatic dilations or botulinum toxin injections can be used to palliate symptoms in patients unfit for definitive surgery, as recommended by guidelines.^{1,16-20}

These approaches have lower upfront risk, though they may need to be repeated to maintain relief. On the other end of the spectrum, pediatric achalasia is a rare but challenging scenario where long-term considerations are paramount. Children and adolescents with achalasia have many decades of life ahead, so a durable solution is desired to minimize the cumulative interventions.

Recent evidence suggests that surgical myotomy should be strongly considered as first-line therapy in children. A 2022 multicenter study compared outcomes of Heller myotomy versus endoscopic dilations in pediatric achalasia (median age 12 years).³ The results showed Heller myotomy was significantly more effective: after initial treatment, the probability of remaining symptom-free without the need for retreatment was much higher in the surgery group (median survival without failure 49 months) than in the dilation group (7 months).³ In fact, after adjusting for confounders, Heller myotomy was about four times more likely to achieve treatment success compared to dilation in children (hazard ratio ~3.93 in favor of myotomy).³ Notably, the complication rates did not differ significantly between pediatric myotomy and dilation—serious adverse events were uncommon in both, and the overall complication frequencies (~35% for surgery vs ~30% for dilation) were not statistically different.³

These findings reinforce that, even in young patients, a surgical approach can be safely performed and offers superior long-term efficacy. Therefore, many pediatric specialists advocate early Heller myotomy (or POEM, in some centers) for children with achalasia, reserving dilation only for select cases. In sum, patient-specific factors such as age, overall health, and specific circumstances (e.g., prior surgeries or anatomical considerations) must be weighed alongside achalasia subtype in determining the optimal treatment approach.

Long-term outcomes and follow-up

Achalasia is a chronic condition, and none of the available treatments cure the underlying motility disorder; they all serve to mitigate the functional

obstruction at the LES. Consequently, long-term follow-up is crucial, as symptom relapse can occur years after an initially successful treatment. Studies with extended follow-up have shown that the efficacy of all therapies can decline over time.

Approximately 5–10% of patients may experience symptom recurrence within the first 1–2 years after a successful myotomy or dilation, and relapse rates can exceed 20–30% at 10 years post-treatment in some series.¹ The need for additional or repeat interventions (for example, a repeat dilation, a re-do myotomy, or conversion to another modality) is part of achalasia management.

Fortunately, if one treatment fails, patients often respond well to an alternate therapy. For instance, a patient who has persistent or recurrent dysphagia after Heller myotomy can undergo pneumatic dilation with good results, and conversely, a patient who fails repeated dilations can be referred for a myotomy; both the ACG and ASGE guidelines endorse using the complementary modality in the event of treatment failure (PD after failed myotomy, or myotomy after failed PD) rather than simply repeating the same approach indefinitely.^{1,2}

Similarly, a POEM can be performed after a prior Heller myotomy or vice versa, as salvage therapy, with evidence suggesting it is safe and effective in the redo setting.¹ Surveillance after achalasia treatment primarily involves clinical assessment of symptoms (using tools like the Eckardt score) at regular intervals. Objective tests such as timed barium swallow or manometry can be considered if symptoms worsen, to distinguish anatomic issues (e.g. a tight fundoplication or sigmoid megaesophagus) from simply residual motility problems. Another aspect of long-term management is monitoring for complications of chronic achalasia.

Even after successful LES treatment, some patients develop esophageal dilation or residual food stasis that can lead to aspiration or rarely, esophageal diverticula. There is also a recognized, though low, risk of esophageal squamous cell carcinoma in longstanding achalasia due to chronic stasis and inflammation; thus, periodic endoscopic evaluation may be recommended beyond 10–15 years of disease duration.

In summary, current evidence supports a paradigm in which achalasia is managed as a chronic disease: initial therapy is tailored to the patient to provide the best chance of symptomatic relief, and patients are followed long-term with readiness to employ supplementary treatments if needed. The goal is to maintain symptom remission and nutrition over the patient's lifetime, using the full arsenal of therapies (endoscopic, surgical, pharmacologic) as necessary.

CONCLUSION

Achalasia management has evolved into a multidisciplinary, tailored approach grounded in a strong evidence base. Heller myotomy, especially via a minimally invasive laparoscopic approach with partial fundoplication, remains a cornerstone of treatment with a high rate of durable symptom relief. The emergence of POEM as an endoscopic alternative has expanded the treatment options, offering efficacy on par with surgical myotomy for esophageal clearance and symptom improvement. Pneumatic dilation continues to be an effective, less invasive therapy, particularly suitable for patients who prefer to avoid surgery or when surgical risk is high.

Current evidence indicates that for most patients with achalasia subtypes I and II, any of the definitive therapies (PD, LHM, or POEM) can achieve good outcomes, allowing physicians to individualize the choice based on patient preferences, anatomical considerations, and local expertise.

For subtype III achalasia, a tailored myotomy (Heller or POEM) is recommended to ensure adequate disruption of the spastic segment, as this subtype is less responsive to dilation. The use of a partial fundoplication in conjunction with Heller myotomy has been reaffirmed by recent data: it confers a significant protective effect against postoperative reflux without impairing esophageal emptying, dispelling prior concerns about its use in aperistaltic esophagi.

As such, surgical myotomy with fundoplication offers the dual benefit of dysphagia relief and reflux prevention, an advantage over POEM that must be weighed when choosing therapy. In pediatric achalasia, where long-term remission is especially desirable, Heller myotomy has shown superior efficacy to dilations, suggesting that early definitive therapy can improve outcomes in younger patients. Advances in surgical technology, like robotic-assisted myotomy, are refining the technical delivery of therapy, although the fundamental clinical outcomes are similar to established methods. Looking ahead, ongoing research is focused on optimizing achalasia care—for instance, enhancing endoscopic techniques to include reflux mitigation, identifying predictors (such as genetic or microbiome factors) of therapy response, and improving management of end-stage achalasia.

In conclusion, the current evidence supports an algorithm in which achalasia is diagnosed promptly with high-resolution manometry, stratified by subtype, and managed with an individualized treatment plan. Heller myotomy remains a highly effective treatment and, in the era of POEM and other advances, continues to play a vital role, integrated within a spectrum of therapies that together can achieve symptomatic control for the vast majority of patients with this once-devastating

esophageal disorder. The multidisciplinary collaboration between gastroenterologists and surgeons, as reflected in recent guidelines, ensures that patients receive the most appropriate therapy for their situation, maximizing the likelihood of long-term relief and improved quality of life.

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