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ORIGINAL RESEARCH

Same Day Discharge After Minimally Invasive Heller Myotomy: One Surgeon's Experience

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ABSTRACT

Background: Minimally invasive Heller myotomy (MI-HM) with partial fundoplication is a popular treatment for achalasia. Recent advancements in minimally invasive techniques and enhanced recovery after surgery (ERAS) protocols have facilitated same-day discharge (SDD) for various procedures, promoting cost savings and enhanced patient satisfaction. However, limited data exist on the feasibility and safety of performing MI-HM as an ambulatory operation. This study aimed to evaluate the discharge rate occurring on the same day as surgery, postoperative complications, and reasons for delayed discharge in a single-surgeon cohort of MI-HM patients.

Methods: A retrospective review was conducted of 157 consecutive MI-HM cases performed by a single surgeon from 2018 to 2024 at an integrated healthcare system. All patients were evaluated preoperatively with high-resolution manometry, endoscopy, and esophagram. Procedures were performed laparoscopically ($n = 35$) or robotically ($n = 122$), with all patients receiving Dor fundoplication. SDD was defined as discharge on postoperative day 0. Primary endpoints included SDD rates and reasons for delayed discharge. Secondary endpoints were 30-day emergency department (ED) visits and postoperative complication rates. Data were analyzed descriptively and stratified into quartiles to assess temporal trends in SDD success.

Results: Of the 157 patients, 132 (84.1%) were discharged on postoperative day 0, with SDD rates improving from 58% in the first quartile to over 90% in subsequent quartiles. Delayed discharge occurred in 25 patients due to patient preference (36%), surgeon discretion (20%), or emesis/aspiration (20%). The overall complication rate was 2.6%, including three aspiration events and one contained leak (0.6%). No reinterventions or mortalities occurred. Out of the 157 patients, 16 patients (10.2%) presented to the ED within 30 days, and from those 16, 13 (8.28%) had surgically related complaints. From the 132 ambulatory patients, 4 (3.03%) presented within 48 h of discharge. Overall reasons for ED presentation were pain, urinary issues, and a contained leak, which was treated conservatively with antibiotics.

Conclusions: This study demonstrates that MI-HM is safe, feasible, and associated with low complication and readmission rates when approached as an ambulatory procedure. Improvements in SDD rates over time reflect enhanced team familiarity and protocol optimization. Given the unique physiological and functional benefits of MI-HM with Dor fundoplication, these findings support its continued use as a treatment for achalasia, with the ambulatory model potentially offering significant cost and resource management benefits. Further studies are warranted to evaluate the generalizability of these findings across diverse healthcare settings.

1 | Introduction

Laparoscopic esophagogastric myotomy in combination with a partial wrap fundoplication has long been a popular operation for the surgical treatment of achalasia. This approach has proven superior outcomes to both open myotomy and thoracoscopic myotomy [1]. Given advances in technique and more widespread utilization of minimally invasive surgery, lengths of stay have become increasingly reduced without an increase in morbidity or mortality. Furthermore, shorter hospital stays have been associated with enhanced patient satisfaction and reduced institutional costs [2–7]. Advances in application of enhanced recovery after surgery (ERAS) protocols coupled with environmental demands for optimal resource management under constraints of the COVID pandemic have accelerated this model's demand. In 2022, our group published on the safety and feasibility of same day discharge (SDD) for benign foregut surgery after implementation of a same-day home recovery (SDR) program [2]. Since our publication, to our knowledge, there has not been a follow-up study replicating the safety and feasibility of the program. Furthermore, limited data exist particularly for ambulatory MI-Heller myotomy. Herein, our primary aim was to present a series of operations performed between 2018 and 2024 to demonstrate the percentage of patients that were discharged on the same day of surgery after minimally invasive Heller myotomy. Our secondary aim was to describe postoperative admission rates, ED visits within 30 days, and assess reasons for failed discharge on POD 0.

2 | Methods

Our retrospective study included adults ages > 18 diagnosed with achalasia requiring surgical intervention in an integrated healthcare system serving a sociodemographically diverse population in Northern California. Electronic health records were analyzed at our integrated health system which currently provides comprehensive medical care services to over 4.5 million enrolled health plan members—nearly a third of the population in its service area—at 21 hospitals and over 240 outpatient clinics. Our center is part of the Permanente Benign Foregut Surgery group, which has previously published on the safety and feasibility of home recovery after benign foregut surgery [2].

All patients that were candidates for general anesthesia were considered for minimally invasive Heller myotomy and SDD. Redo procedures and urgent and emergent operations were excluded from the study. All patients had undergone endoscopy, high-resolution manometry, and esophagram studies. They were evaluated and referred by the gastroenterology department prior to the operation. All procedures were performed by the same surgeon, either laparoscopically (n = 35) or with the Davinci robotic system (n = 122). As the robotic system was introduced in our medical center, the surgical approach rapidly shifted from straight stick laparoscopy to the robotic platform. The myotomy during the laparoscopic procedure was created by distracting the muscle fibers with cold instrument distraction. For the robotic myotomies, hook cautery was employed. EndoFLIP guidance was utilized once we transitioned to the robotic approach. This allowed us to optimize the length of the myotomy as the LES was more precisely targeted. We found that the historically recommended 6–8 cm mytomy was, most times, unnecessary. The myotomy edges were sutured to either crus to prevent scarring and reapproximation of the muscle layer. A standard DOR fundoplication was then performed. Short gastric vessel division was performed at the discretion of the surgeon. Intraoperatively, no routine leak test was performed (i.e., no upper endoscopy). Standard insufflation pressure was used (~15 mmHg). No routine postoperative radiology studies (i.e., esophagram) were performed. These tests were abandoned early in the surgeon's experience as they failed to alter the postoperative course or length of stay.

Clear liquids were started in the postanesthesia care unit and continued through postoperative day two. Diet was advanced to full liquids during postoperative days three and four, and to soft solids during postoperative days five and six. By postoperative day eight, patients were free to take regular solids. Standard postoperative prescriptions included liquid Hycet to take for breakthrough pain, Motrin chews, and liquid Colace. Perioperative management was consistent with the ERAS protocol. Patients had a planned telephone visit with their surgeon on postoperative day one. In actuality, most were reached on postoperative day one, eleven on postoperative day two, and two on postoperative day three. Patients that were discharged home directly from the postanesthesia care unit were categorized as SDD. Patients who stayed past 12 a.m. were considered non-SDD. The primary end point was rate of SDD after MI-Heller myotomy. The secondary end points were postoperative admission rate and 30-day presentation ED visit rates.

This is a single-arm descriptive study of prospectively obtained data; therefore, the focus was on summarizing the characteristics of our 157-patient sample group (Table 1). This was accomplished by calculating the percentage of patients discharged from the postanesthesia care unit. Similarly, percentages were used to quantify the number of ED presentations and complications within 30 days. Reasons for prolonged discharge after surgery were categorized into three groups. Furthermore, continuous data were organized into quartiles from 9/27/2018 to 8/01/2024 to better represent SDD success and relative complication as a function of the duration of the adapted protocol.

3 | Results

The group included in the study is comprised of an even number of male and female patients as well as a wide range of BMI and age values. Notably, most patients had type 2 achalasia (Table 1). Absence of type 3 achalasia patients in our cohort is a reflection of our institution's treatment protocol, where all type 3's are treated by gastroenterology via POEM. Cases listed as "indeterminate type," refers to those that were not clearly type 1 or 2 on functional manometry. A total of 157 consecutive MI-Heller myotomies were planned for the same-day discharge. 132 (84.1%) were discharged successfully on POD 0, 24 (15.2%) on POD 1, and 1 (0.6%) on POD 5. The most common reasons for delayed discharge were patient preference (9/25, 36%), surgeon discretion (5/25, 20%), and emesis or aspiration (5/25,

20%). No patient was admitted for observation solely due to their preexisting condition/comorbidity. When separated by quartiles, the rates of SDD were as follows: *Q*1 = 58%, *Q*2 = 90%, Q3, 97%, and Q4 92% (Figure 1). The quartile dates were as follows: 9/27/18–9/20/19 (Q1), 10/11/19–7/28/21 (Q2), 8/18/21–12/14/22 (Q3), and 1/23/23–8/1/24 (Q4). The complication rates per quartile were 8%, 10%, 13%, and 8%, respectively. Overall, the complication rate was 4/157 (2.6%). Three of the four complications were aspiration events, and one of the four was a contained leak. The overall leak rate was 1/157 (0.6%). None of the patients required surgical or endoscopic reintervention. There were no mortalities. Within 30 days, 16/157 (10.2%) of patients visited the emergency department. From these 16 visits, 13 were related to their recent surgery (Figure 2). The most common reason for presentation was postoperative pain (8/13), with two patients presenting within the first 48 h of discharge, and the majority between POD5 and POD20 (Figure 1). From the 13 surgery-related ED visits, only one patient required admission for conservative management of a contained leak and was discharged after seven days of being treated with antibiotics without drain placement. The other 12 patients were discharged from the emergency department with reassurance after a negative work-up (Figure 2).

TABLE 1 | Demographics table.

	# Of patients	% Of patients
Sex		
M	79	50%
F	78	50%
Age		
18–45	56	36%
46–65	57	36%
65–85	43	27%
85+	1	1%
BMI		
< 18.00	3	2%
18.00–25.00	67	43%
25.01–35.00	73	46%
> 35.00	14	9%
Comorbidities		
DM	51	32%
HTN	30	19%
HLD	23	15%
Cardiac[a]	26	17%
COPD	7	4%
Anticoagulation	1	1%
Depression	13	8%
None	31	20%
Achalasia type		
I	10	6%
II	138	88%
Indeterminate	9	6%

[a]Includes CHF, CAD, AFib, and valve insufficiency.

4 | Discussion

To our knowledge, this is the largest case series evaluating feasibility of discharge on the same day after MI-Heller myotomy. The adoption of this initiative increased with time as noted by linearly increasing quartile SDD rates (Figure 1). This increase is associated with familiarity of the protocol and buy-in from other members of the care team. Initially, postanesthesia care unit (PACU) nurses were hesitant to discharge, but with education about the safety of the protocol, they became more encouraging and provided reassurance to patients who then felt at ease to pursue home-recovery. Our rate of discharge on same day as surgery (84.1%) is comparable with what has been previously reported in the literature [4, 8]. Notably because the discharge rate is skewed (i.e., increased in frequency with familiarity), we anticipate that with time the discharge rate will be consistently > 90%. The most common reason for ED presentation was postoperative pain (chest/abdominal), found to be of no clinical significance (i.e., normal cardiac work-up, no pneumothorax, and no signs of infection). A chart review was

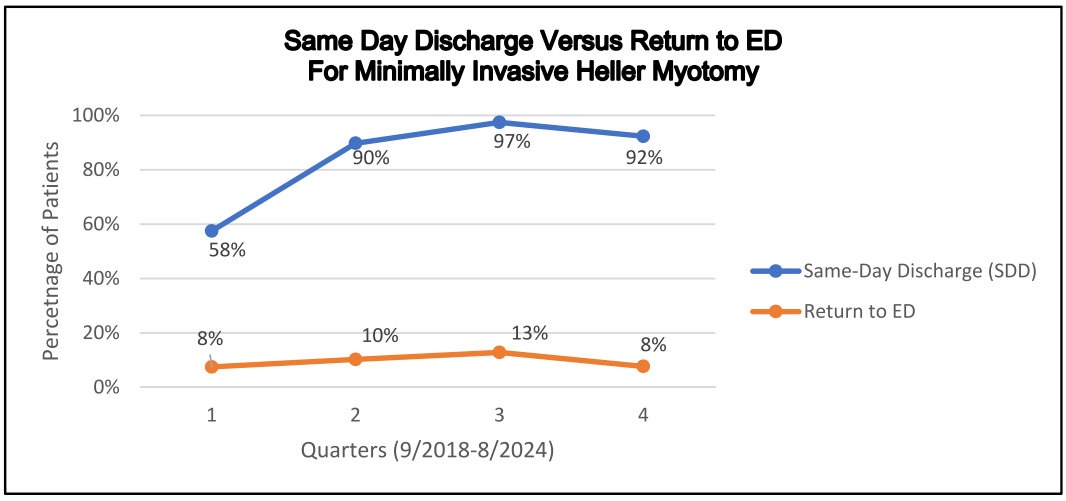

FIGURE 1 | Quartile data.

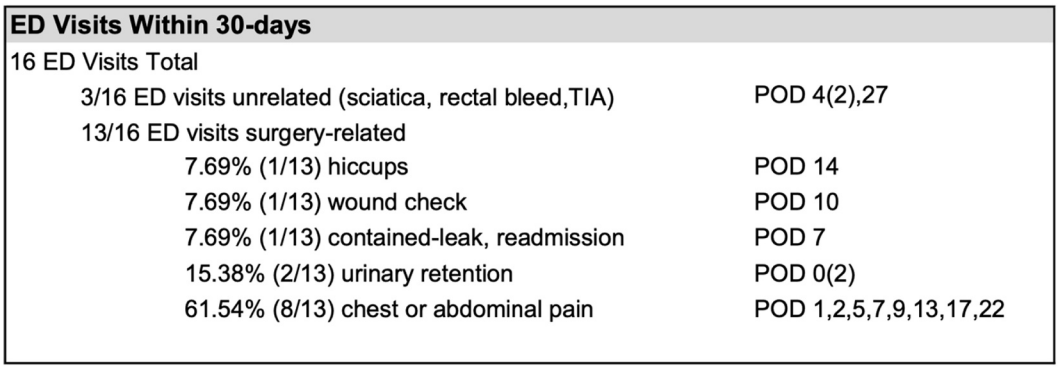

FIGURE 2 | Reasons for presentation to the emergency department within 30 days of surgery.

performed to understand the characteristics of the patients presenting for pain. It was noted that patients were more likely to be female (5 female vs. 2 male), to have a diagnosis of chronic pain in the medical record (3 patients), or to have a diagnosis of a mood disorder (3 patients) in medical record. Although not statistically analyzed, the overrepresentation of certain patient traits suggests that more in-depth education preoperatively and postoperatively should be given to a subgroup of patients especially regarding pain expectations. During the course of the study period, a better job was done by both surgeon and support care team setting consistent expectations of postoperative pain (shoulder and neck pain due to CO_2 insufflation), during both preoperative and postoperative phases.

Furthermore, use of postoperative telehealth-based communication was encouraged. The ability for the surgeon to be able to speak with the patient on POD one is critical—highlighting the value of an integrated health care system with sufficient operational support for remote telehealth visits. The majority of patients were called by operating surgeon on POD1. 11 patients were called by POD2 and 2 by POD3. The main reason for delay included inability to reach the patient on first attempt. The value of the immediate postoperative telehealth visit rests on an established relationship between the patient and surgeon. During the first point of contact with the surgeon in clinic, we "plant the seed" that this is an ambulatory procedure and that there is an expectation to discharge on the same day of surgery. We communicate that a brief check-in will occur in the first postoperative day via telephone with the operating surgeon. During the preoperative visit, we also ensure that the patient's and their primary contact's phone numbers are in our system. On the day of surgery, education is given in the preoperative area by the surgeon and postoperatively by the nurse in the postanesthesia care unit. Postoperatively the nurse provides written and verbal instructions that have been prepared by the surgeon. In short, the written discharge instructions include expectations and symptoms/signs to look out for that would prompt a call back/or visit to the emergency room. The same-day protocol mirrors that published previously by our group [2].

Our sentiment echoes that of other advocates for discharge on the day of surgery, who have stated that the most important step in achieving SDD was the readiness of a trained team [9]. 132 out of 157 patients were successfully discharged on POD 0, with 13 of 132 (9.84%) presenting to ED within 30 days (the latter number decreasing during the course of the study as education was reinforced regarding expectations of postoperative pain). Of the 25 patients that were not discharged on the day of surgery, LOS was $\leq$ 25 h. It has been previously reported that on average, there is approximately 850 US dollars in hospital charges made to the patient for each admission day after MI-HM [3]. Although not the focus of the study, even after accounting for ED presentations (only one of the 10 requiring readmission for antibiotic treatment of a contained leak), one can deduce the cost savings when compared to admitting all patients to the inpatient setting beyond the postoperative observation allowance. Undoubtedly, one of the main reservations of SDD is the concern for potentially catastrophic postoperative complications, such as leak. The net operative complication rate of our cohort is 2.6% which is lower than intraoperative and postoperative rates reported (8.8% and 6%–15.3%, respectively) in the literature [4, 5].

Our leak rate of 0.6% is comparable to the leak rate reported at high volume, specialized esophageal centers performing Heller myotomies [10, 11]. This likely reflects surgeon experience coupled with the precision of the robotic platform, which provides optimal visualization to prevent or detect perforations and ischemic changes from cautery in real-time, along with the effective use of EndoFLIP as an adjunctive tool objectively measuring real-time functionality of the LES to guide optimal length of the myotomy. We believe that the objective distensibility index feedback helps tailor the final length to each patient's functional response, improving dysphagia relief while avoiding needless extra muscle division, which puts patients at risk for reflux, perforation, and longer time under general anesthesia. Although further studies will be required to validate long-term postoperative outcomes, the literature echoes the sentiment that the use of the historical 6–8 cm myotomy for all patients may shift into a more individualized approach based on each patient's distensibility index on EndoFLIP [12–16]. Routine postoperative UGI and intraoperative tests were performed previously by the surgeon and never revealed any useful information and were therefore abandoned. The one leak in our series was likely thermal (as the robot platform magnification would show a perforation) and therefore not likely to show up on EGD or UGI. Even by nonambulatory surgical standards for foregut surgery, the patient would have been discharged well before POD 7 (day patient presented to ED with symptoms of fever). Across contemporary series and a large meta-analysis, most elective robotic Heller myotomy patients leave hospital on postoperative day 1–2 [17–19]. Consideration for application of real-time near-infrared ICG in the context of Heller myotomy to

confirm mucosal integrity has been reported and may be of study value to establish if (a) ischemic changes can be identified intraoperatively and if (b) recognition of such lead to a decrease incidence of delayed perforations [20].

The strengths of this study include its setting in an integrated community-based health plan; a large number of patients for the specific operation and access to detailed prospectively recorded medical information. A limitation of the study is the focus on an individual surgeon's cohort, with expertise that may be superior to the average surgeon. Furthermore, no analysis was completed regarding preexisting demographic differences, including comorbidities, size of hiatal hernia (if existing), previous abdominal surgery, time of surgery, or details of clinical symptoms. However, this series consists of all consecutive patients who underwent these benign foregut surgeries, minimizing selection bias. Lastly, another possible limitation of this study is its generalizability in centers that do not have the volume and infrastructure to support this same day discharge practice safely.

5 | Conclusions

In this study, we demonstrate that same-day discharge after MI-HM was feasible, safe, and effective. In a time of competing, less invasive, treatment modalities offered for achalasia, such as balloon dilations, Botox injections, and POEM (per-oral endoscopy myotomy), it is important to remember the advantages of Heller myotomy and Dor fundoplication that are unique to this operation: significant relief of dysphagia with long-term mitigation of postmyotomy reflux through an anatomical correction.

Author Contributions

Alberto Jarrin Lopez: conceptualization, data curation, formal analysis, investigation, methodology, writing – original draft, writing – review and editing. **Cynthia Susai**: conceptualization, data curation, formal analysis. **Jonathan D. Svahn**: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, supervision, writing – review and editing.

Disclosure

The authors have nothing to report.

Ethics Statement

This study was approved by the Kaiser Permanente Northern California Institutional Review Board.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. R. P. Lin, M. Napolitano, A. D. Sparks, and J. Lee, "Laparoscopic Heller Myotomy Is Associated With Fewer Postoperative Complications Compared to the Thoracoscopic Approach: A NSQIP Study," *Journal of the American College of Surgeons* 233, no. 5S1 (2021): S17–S18, https://doi.org/10.1016/j.jamcollsurg.2021.07.009.

2. S. H. Teh, S. C. Schecter, E. B. Servais, et al., "Same-Day Home Recovery for Benign Foregut Surgery," *JAMA Surgery* 157, no. 11 (2022): 1000–1006, https://doi.org/10.1001/jamasurg.2022.4245.

3. G. Zambito, G. Fritz, and A. Banks-Venegoni, "A Fast Track to Foregut Surgery: Pandemic-Driven Protocol Development," *Americas Journal of Surgery* 225, no. 2 (2023): 481–484, https://doi.org/10.1016/j.amjsurg.2023.01.006.

4. J. C. Molina, A. M. Misariu, I. Nicolau, et al., "Same Day Discharge for Benign Laparoscopic Hiatal Surgery: A Feasibility Analysis," *Surgical Endoscopy* 32, no. 3 (2018): 937–944, https://doi.org/10.1007/s00464-017-5769-5.

5. M. Victorzon, P. Tolonen, and T. Vuorialho, "Laparoscopic Floppy Nissen Fundoplication for Gastrooesophageal Reflux Disease Is Feasible as a Day-Case Procedure," *Scandinavian Journal of Surgery* 95, no. 3 (2006): 162–165, https://doi.org/10.1177/145749690609500306.

6. E. Trondsen, O. Mjaland, J. Raeder, and T. Buanes, "Day-Case Laparoscopic Fundoplication for Gastrooesophageal Reflux Dis- Ease," *British Journal of Surgery* 87, no. 12 (2000): 1708–1711, https://doi.org/10.1046/j.1365-2168.2000.01578.x.

7. C. Gronnier, A. Desbeaux, G. Piessen, et al., "Day-Case versus Inpatient Laparoscopic Fundoplication: Outcomes, Quality of Life and Cost-Analysis," *Surgical Endoscopy* 28, no. 7 (2014): 2159–2166, https://doi.org/10.1007/s00464-014-3448-3.

8. L. Fuccio, A. Farioli, L. Frazzoni, et al., "Progression of Gastroesophageal Reflux Disease to Barrett's Esophagus and Esophageal Adenocarcinoma: A Systematic Review and Meta-Analysis," *Surgical Endoscopy* 36, no. 7 (2022): 4690–4699, https://doi.org/10.1007/s00464-021-08951-8.

9. C. Kaushik, M. Milhoan, A. Khanna, et al., "Laparoscopic Heller Myotomy and Dor Fundoplication in the Same Day Surgery Setting With a Trained Team and an Enhanced Recovery Protocol," *Surg Open Sci* 1, no. 2 (2019): 64–68, https://doi.org/10.1016/j.sopen.2019.06.003.

10. G. Zaninotto, M. Costantini, C. Rizzetto, et al., "Four Hundred Laparoscopic Myotomies for Esophageal Achalasia: A Single Centre Experience," *Annals of Surgery* 248, no. 6 (2008): 986–993, https://doi.org/10.1097/sla.0b013e3181907bdd.

11. A. S. Rosemurgy, C. A. Morton, M. Rosas, M. Albrink, and S. B. Ross, "A Single Institution's Experience With More Than 500 Laparoscopic Heller Myotomies for Achalasia," *Journal of the American College of Surgeons* 210, no. 5 (2010): 637–645, https://doi.org/10.1016/j.jamcollsurg.2010.01.035.

12. A. Ilczyszyn, K. Hamaoui, J. Cartwright, and A. Botha, "Intraoperative Distensibility Measurement During Laparoscopic Heller's Myotomy for Achalasia May Reduce the Myotomy Length Without Compromising Patient Outcome," *Diseases of the Esophagus* 29, no. 5 (2016): 455–462, https://doi.org/10.1111/dote.12343.

13. E. N. Teitelbaum, L. Boris, F. O. Arafat, et al., "Comparison of Esophagogastric Junction Distensibility Changes During POEM and Heller Myotomy Using Intraoperative FLIP," *Surgical Endoscopy* 27, no. 12 (2013): 4547–4555, https://doi.org/10.1007/s00464-013-3121-2.

14. E. N. Teitelbaum, N. J. Soper, J. E. Pandolfino, et al., "An Extended Proximal Esophageal Myotomy Is Necessary to Normalize EGJ Distensibility During Heller Myotomy for Achalasia, but Not POEM," *Surgical Endoscopy* 28, no. 10 (2014): 2840–2847, https://doi.org/10.1007/s00464-014-3563-1.

15. R. K. DeHaan, M. J. Frelich, and J. C. Gould, "Intraoperative Assessment of Esophagogastric Junction Distensibility During Laparoscopic Heller Myotomy," *Surgical Laparoscopy Endoscopy & Percutaneous Techniques* 26, no. 2 (2016): 137–140, https://doi.org/10.1097/SLE.0000000000000245.

16. B. Su, C. Dunst, J. Gould, et al., "Experience-Based Expert Consensus on the Intra-Operative Usage of the Endoflip Impedance Planimetry System," *Surgical Endoscopy* 35, no. 6 (2021): 2731–2742, https://doi.org/10.1007/s00464-020-07704-3.

17. S. M. Rabe, E. Burmeister, S. Niebisch, and I. Gockel, "Clinical and Functional Outcome Following Robotic Heller-Myotomy With Partial Fundoplication in Patients With Achalasia," *J Robot Surg* 17, no. 4 (2023): 1689–1696, https://doi.org/10.1007/s11701-023-01557-3.

18. Z. W. Sollie, A. Z. Jiwani, and B. Wei, "Robotic Heller Myotomy," *Mini-Invasive Surg* 4 (2020): 80, https://doi.org/10.20517/2574-1225.2020.81.

19. S. Horgan, C. Galvani, M. V. Gorodner, et al., "Robotic-Assisted Heller Myotomy versus Laparoscopic Heller Myotomy for the Treatment of Esophageal Achalasia: Multicenter Study," *Journal of Gastrointestinal Surgery* 9, no. 8 (2005): 1020–1030, https://doi.org/10.1016/j.gassur.2005.06.026.

20. S. Gadiyaram, R. Thota, and M. Nachiappan, "Use Real-Time Near-Infrared Fluorescence During Heller's Cardiomyotomy for Achalasia Cardia," *Journal of Minimal Access Surgery* 19, no. 3 (2023): 447–449, https://doi.org/10.4103/jmas.jmas_194_22.