

## Original Research Article

# Dor fundoplication for achalasia of the esophagus: is it time to simplify the established technique? evaluation of clinical outcome

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## ABSTRACT

**Background:** Surgery is the most efficient treatment to achalasia of the esophagus with a success rate estimated 90%. Laparoscopic myotomy is combined with a fundoplication. One of the most common types of wrap is the anterior partial fundoplication, also known as Dor fundoplication. The 10% of surgical failure has been attributed to incomplete myotomy and/or tight fundoplication. The present study describes a modified anterior partial fundoplication that may have the potential to improve the clinical outcome of surgical treatment for achalasia.

**Methods:** In this prospective study, we describe a modification of the standardized technique of Dor fundoplication applied to twenty-nine achalasia patients with intention to decrease the rates of failure. Short-term clinical result was evaluated with preoperative and six- months postoperative Eckardt scores (ES).

**Results:** The mean number of months from initial symptoms to the time of diagnosis was 35.5 months (range 3-156 months). According to the Chicago Classification (CC v3.0), 11 patients (37.9%) were classified as achalasia type I, 17 (58.6%) as type II and 1 (3.4%) as type III. The mean ES was diminished from 7.8 to 0.6 postoperatively.

**Conclusions:** The modification proposed in the present study omits the fixation of the right side of the myotomy to the right crus. This alteration may have the potential to anatomically and functionally affect postoperative rates of dysphagia and antireflux result among patients surgically treated for achalasia.

**Keywords:** Achalasia, Esophageal motility disorders, Fundoplication, Myotomy

## INTRODUCTION

Achalasia of the esophagus is one of the rarest but most extensively studied and described motility disorders of the esophagus. Incidence of achalasia is estimated one in 100.000 individuals annually and its prevalence is ten in 10.000 in the Western World. The seventh decade presents with the greatest incidence among all ages.<sup>1</sup> It is a functional disorder caused by irreversible degeneration of esophageal myenteric plexus neurons that results in

incomplete or absent relaxation of the lower esophageal sphincter (LES) and failed or simultaneous contractions of the esophageal body during deglutition. Etiology of this mechanism remains indeterminate.<sup>2,3</sup> Typical symptoms of achalasia are summarized in the currently used Eckardt score, which evaluates grade of dysphagia to solids and liquids, chestpain, weight loss and regurgitation in a scale of zero to three. Apart from clinical assessment and endoscopy which is essential to rule out malignancy, high resolution manometry (HRM)

has been widely established as a reliable and specific tool for the diagnosis of the disease. HRM analysis was recently updated by the Chicago Classification (CC) v3.0, which classifies achalasia into three types based on different patterns of non-peristaltic esophageal pressurization during swallowing in combination with impaired relaxation of the LES.<sup>4</sup>

Several treatment options have been proposed and evaluated. The goal of treatment is exclusively palliative promoting relief of dysphagia. More precisely, oral pharmacologic therapy with calcium channel blockers, long-acting nitrates and Sildenafil, endoscopic botulinum toxin injection therapy and pneumatic dilation have been applied with various results.<sup>3-5</sup> Per-oral endoscopic myotomy (POEM) is an emerging novel endoscopic approach to the disease without convincing evidence on long-term results as no randomized trials have been published yet. Taking under consideration all currently used techniques, surgical treatment, which consists of myotomy combined with fundoplication predominantly performed laparoscopically, seems to be the most effective approach to dysphagia followed by lower rates of morbidity in comparison to the other treatment options.<sup>5</sup>

Standardized surgical treatment for achalasia includes myotomy and fundoplication. In addition to myotomy, a fundoplication completes the technique as it has the potential to prevent postoperative gastroesophageal reflux (GER). Success rate of the technique in regards of dysphagia is estimated up to 90%, while the risk of postoperative GER is reduced from 31.5% to 8.8% when a partial wrap of the fundus is created.<sup>5</sup> Interestingly, randomized trials outline that Dor as an addition to myotomy is superior to myotomy alone in terms of postoperative GER.<sup>6,7</sup> This finding was evaluated with both symptom referring and objective studies such as pH monitoring tests. The type of fundoplication has been a field of controversy. There have been studies analyzing the comparison between Dor, Toupet, Nissen fundoplication and gastropexy techniques favoring partial wraps such as Dor and Toupet mainly because of lower rates of dysphagia when compared to 360° wraps.<sup>7-9</sup> Review of the Toupet process, however, reveals the need for extended and circumferential mobilization of the lower esophagus and esophageal hiatus which may threaten the trunks of vagus nerve.<sup>10</sup> Therefore, the preferred routine fundoplication is the Dor technique.<sup>9</sup>

Shimi et al firstly presented laparoscopic Heller myotomy and Pellegrini et al reported the thoracoscopic approach in 1991 and 1992, respectively.<sup>11,12</sup> The method consists of mobilization of the right diaphragmatic crura and the anterior surface of the lower esophagus so that an extended myotomy about 7 cm in length, approximately 5 cm proximal and 2 cm distal, can be performed. A partial 180° anterior fundoplication is performed by twice suturing the gastric fundus to the left side of the myotomy and then completing the technique with two interrupted

sutures between the stomach 2 cm laterally to the first suture, the right side of the myotomy and the right crus. The standardized Dor technique does not require incision of short gastric vessels.

The aim of the present study is to introduce and evaluate the clinical outcome of a new altered method for the surgical treatment of achalasia. Therefore, we describe a modified anterior partial fundoplication applied to twenty-nine patients in addition to myotomy during laparoscopy for the treatment of achalasia of the esophagus.

## METHODS

This is a prospective pilot study including twenty-nine patients diagnosed with achalasia between April 2015 and June 2016, who underwent laparoscopic Heller myotomy and modified Dor fundoplication. Manometry of the esophagus was the selected diagnostic tool for all patients. Patient demographics and all kind of previous therapeutic interventions in the esophagus were reviewed. Inclusion criteria were age >18 years old and no history of previous surgical or endoscopic treatment for achalasia. Patients with end-stage achalasia who underwent either myotomy alone or myotomy with esophagopexy were excluded as well.

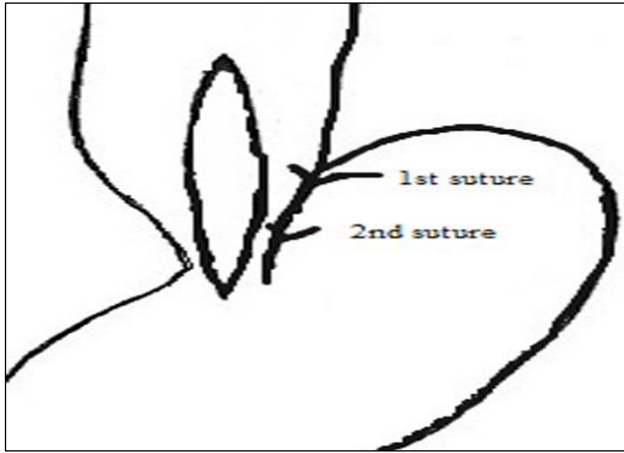
All patients underwent laparoscopic myotomy with additional anterior partial fundoplication by the same surgeon and were evaluated both preoperatively and three months postoperatively with Eckardt scores to assess grade of dysphagia, chestpain, weight loss and regurgitation.

### *Surgical technique*

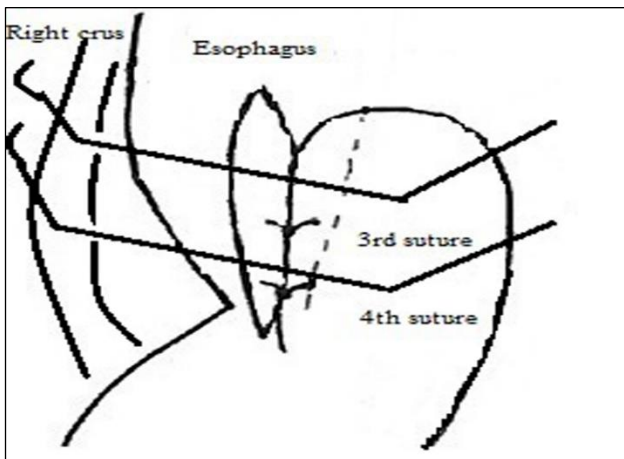
The established Heller-Dor technique for achalasia of the esophagus is widely performed laparoscopically. Incision of the phrenoesophageal membrane permits exposure of the anterior surface of the lower esophagus and the esophageal hiatus. Short and posterior gastric vessels are divided up to the left crus and the fat pad of the gastroesophageal junction is optionally removed. After an approximately 7 cm myotomy of the muscular layer of the esophagus, all structures are completely mobilized so that a wrap construction can be applied. Dor fundoplication is originally performed by double suturing the gastric fundus to the left side of the myotomy of the esophagus adding two sutures between the fundus, the right side of the myotomy and the right diaphragmatic crus.

Based on the classic technique, we modified the type of the partial fundoplication performing all mobilizations of the structures as aforementioned and the idea of wrapping over the top of the esophagus. However, fundus suturing to the esophageal and hiatal structures was altered. The fundus of the stomach was only fixed to the left side of the myotomy with two interrupted sutures, while the next

two sutures included the fundus about 2 cm laterally to the first steps and right crus completely excluding the right side of the myotomy (Figure 1-2). This alteration was adapted to all patients enrolled to the study.



**Figure 1: Fixation of the gastric fundus to the left side of the myotomy with two sutures.**



**Figure 2: Fixation of the gastric fundus to the right crus with two sutures.**

**RESULTS**

Twenty-nine patients were enrolled. Mean age was 48.6 years old (range 18-79), while 45% were female. The mean number of months from initial symptoms to the time of diagnosis was 35.5 months (range 3-156 months). All patients underwent High Resolution Manometry (HRM) before surgery. According to the Chicago Classification (CC v3.0), 11 patients (37.9%) were classified as achalasia type I, 17 (58.6%) as type II and 1 (3.4%) as type III. Patients’ characteristics are shown in Table 1. The patients included underwent laparoscopic Heller myotomy and an anterior partial fundoplication according to the modified technique as described above.

**Table 1: Patients’ characteristics (n=29).**

Gender	
Female (%)	13 (45)
Male (%)	16 (55)
Mean age in years (range)	48.6 (18-79)
Mean number of months to diagnosis (range)	35.5 (3-156)
Achalasia subtype (%)	
Type I	11 (37.9)
Type II	17 (58.6)
Type III	1 (3.4)

Table 2 reveals the comparison of frequency of both dysphagia and regurgitation preoperatively and postoperatively. More precisely, although 65.5% of the patients suffered from dysphagia during every meal before surgery, 79.4% presented with complete dysphagia relief after surgery. In regards of regurgitation, 89.6% of the cases were free of symptoms postoperatively after complaining of either daily (41.3%) or related to every meal (37.9%) regurgitation before surgical treatment. Furthermore, mean ES was evaluated during the preoperative work up and six months after surgery and was found to be decreased from 7.8 to 0.6 before and after surgery, respectively (Table 2).

**Table 2: Frequency of dysphagia, regurgitation and Eckardt score (ES) before and after surgery.**

n=29 (%)	Preoperatively				Postoperatively			
	0=none	1=occasional	2=daily	3=each meal	0=none	1=occasional	2=daily	3=each meal
Dysphagia	0	17.2	17.2	65.5	79.4	20.6	0	0
Regurgitation	6.8	13.7	41.3	37.9	89.6	6.8	3.4	0
ES	7.8				0.6			

**DISCUSSION**

The most commonly performed surgical treatment for achalasia of the esophagus is laparoscopic Heller myotomy and Dor fundoplication. Myotomy aims

towards the relief of dysphagia and Dor helps in clinical and objective prevention of GER in comparison to Heller myotomy alone.<sup>6</sup>

The proposed extent of the esophagomyotomy is approximately five centimeters from the

gastroesophageal junction proximally to the esophagus and two centimeters distally onto the cardia of the stomach. Almost 90% of patients who undergo surgery postoperatively present with complete relief of their symptoms.<sup>5</sup>

Partial and complete funduplications as well as His fixation have been proposed as antireflux barriers with various results. Di Martino et al showed that Nissen fundoplication presents with better antireflux result as proved objectively based on pH studies without significant difference in clinical outcome when compared to the Dor technique.<sup>8</sup> However, Rebecchi et al revealed that Nissen fundoplication is followed by higher rates of postoperative dysphagia.<sup>9</sup>

On the other hand, the comparison between the results of the anterior and the posterior wrap is not clear. In fact, there have been several studies, such as the randomized trials of Hagedorn et al and Rawlings et al, that resulted in no significant difference in terms of dysphagia relief after surgery among patients who underwent Dor or Toupet fundoplication, but the latter concluded that the Toupet group presented with better 24-h pH test reports.<sup>15,16</sup>

Another randomized trial by Kumagai et al, however, showed superior QOL results and esophageal emptying among patients who underwent a Toupet procedure when compared to the group after Dor technique. This may be attributed to the fact that the Toupet fundoplication aims to keep both myotomy sides apart preventing possible incomplete clearance of globus.<sup>17</sup> Balakrishna et al analyzed the clinical outcome after another antireflux option. When His accentuation was compared to the Dor procedure, QOL assessment came with the same results in both groups.<sup>18</sup>

In current study, the technique demonstrated is a modification of the standardized anterior partial fundoplication also known as Dor fundoplication. Avoiding the fixation of the right side of the myotomy to the right crus is the only technical alteration from the established Dor wrap. This difference may lead to either a less tight wrap or minimize angulation of the anterior side of the lower esophagus. Because of this anatomical change there might be a potential to reduce the failure rate of the technique. Short-term clinical outcome showed improvement of dysphagia and regurgitation postoperatively. Moreover, ES was diminished during the six-month postoperative reevaluation.

## CONCLUSION

Conclusively, this study introduces a simplified version of the Dor technique for the prevention of postoperative reflux after myotomy of the esophagus. Early postoperative result may be further analyzed in the future based on objective studies. There will be required long-term follow-up results as well as an objective assessment

of GER as the proposed technique might introduce more reflux than the standardized technique.

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## REFERENCES

- Francis DL, Katzka DA. Achalasia: update on the disease and its treatment. *Gastroenterol.* 2010;139(2):369-74.
- Ates F, Vaezi MF. The pathogenesis and management of achalasia: current status and future directions. *Gut Liver.* 2015;9(4):449-63.
- Krill JT, Naik RD, Vaezi MF. Clinical management of achalasia: current state of the art. *Clin Exp Gastroenterol.* 2016;9:71-82.
- Kahrilas PJ, Bredenoord AJ, Fox M, Gyawali CP, Roman S, Smout AJ, et al. International high-resolution manometry working group. international high-resolution manometry working group. the chicago classification of esophageal motility disorders, v3.0. *Neurogastroenterol Motil.* 2015;27(2):160-74.
- Campos GM, Vittinghoff E, Rabl C, Takata M, Gadenstätter M, Lin F, et al. Endoscopic and surgical treatments for achalasia: a systematic review and meta-analysis. *Ann Surg.* 2009;249(1):45-57.
- Richards WO, Torquati A, Holzman MD, Khaitan L, Byrne D, Lutfi R, et al. Heller myotomy versus Heller myotomy with Dor fundoplication for achalasia: a prospective randomized double-blind clinical trial. *Ann Surg.* 2004;240(3):405-15.
- Mayo D, Griffiths EA, Khan OA, Szymankiewicz MA, Wakefield CW, Thompson SK. Does the addition of a fundoplication improve outcomes for patients undergoing laparoscopic Heller's cardiomyotomy? *Int J Surg.* 2012;10(6):301-4.
- Di Martino N, Brilliantino A, Monaco L, Marano L, Schettino M, Porfidia R, et al. Laparoscopic calibrated total versus. partial fundoplication following Heller myotomy for oesophageal achalasia. *World J Gastroenterol.* 2011;17(29):3431-40.
- Rebecchi F, Giaccone C, Farinella E, Campaci R, Morino M. Randomized controlled trial of laparoscopic Heller myotomy plus Dor fundoplication versus Nissen fundoplication for achalasia: long-term results. *Ann Surg.* 2008;248(6):1023-30.
- Katada N, Sakuramoto S, Kobayashi N, Futawatari N, Kuroyama S, Kikuchi S, et al. Laparoscopic Heller myotomy with Toupet fundoplication for achalasia straightens the esophagus and relieves dysphagia. *Am J Surg.* 2006;192(1):1-8.

11. Shimi S, Nathanson LK, Cuschieri A. Laparoscopic cardiomyotomy for achalasia. *J R Coll Surg Edinb.* 1991;36(3):152-4.
12. Pellegrini C, Wetter LA, Patti M, Leichter R, Mussan G, Mori T, et al. Thoracoscopic esophagomyotomy. Initial experience with a new approach for the treatment of achalasia. *Ann Surg.* 1992;216:291-9.
13. Patti MG, Fisichella PM, Perretta S, Galvani C, Gorodner MV, Robinson T, et al. Impact of minimally invasive surgery on the treatment of esophageal achalasia: a decade of change. *J Am Coll Surg.* 2003;196:698-705.
14. Pandolfino JE, Gawron AJ. Achalasia: a systematic review. *JAMA.* 2015;313(18):1841-52.
15. Hagedorn C, Jonson C, Lonroth H, Ruth M, Thune A, Lundell L. Efficacy of an anterior as compared with a posterior laparoscopic partial fundoplication: results of a randomized, controlled clinical trial. *Ann Surg.* 2003;238(2):189-96.
16. Rawlings A, Soper NJ, Oelschlager B, Swanstrom L, Matthews BD, Pellegrini C, et al. Laparoscopic Dor versus Toupet fundoplication following Heller myotomy for achalasia: results of a multicenter, prospective, randomized-controlled trial. *Surg Endosc.* 2012;26(1):18-26.
17. Kumagai K, Kjellin A, Tsai JA, Thorell A, Granqvist S, Lundell L, et al. Toupet versus Dor as a procedure to prevent reflux after cardiomyotomy for achalasia: results of a randomised clinical trial. *Int J Surg.* 2014;12(7):673-80.
18. Balakrishna P, Parshad R, Rohila J, Saraya A, Makharia G, Sharma R. Symptomatic outcome following laparoscopic Heller's cardiomyotomy with Dor fundoplication versus laparoscopic Heller's cardiomyotomy with angle of His accentuation: results of a randomized controlled trial. *Surg Endosc.* 2015;29(8):2344-51.

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