Chapter

Surgical Treatment of Esophageal Advanced Achalasia

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Abstract

Of the several procedures that has to treat esophageal achalasia, the esophagectomy is to be the most indicated in advanced disease, which prompted Pinotti the disseminate the transmediastinal esophagectomy technique in the 1970s, with the advantage of avoiding thoracotomy. Nevertheless, several series demonstrated that this technique was not exempt from complications one of which could lead to massive hemopneumothorax due to injury to the trachea- bronchial tree and vessels due the periesophagitis that may be present with consequent adherence of the esophagus to these noble organs. Thus, Aquino in 1996 introduced the esophageal mucosectomy technique with preservation of the esophageal muscle tunic at the level of mediastinum as well as the transposition of the stomach to the cervical region inside in this tunic for the reconstruction of digestive tract. The advantage of this procedure is to avoid transgression of the mediastinum. This author describes in details this procedure, and shows early results and late evaluation using the ECKARDT score in a series of patients showing the advantages of the esophageal mucosectomy due the low incidence of immediate postoperative complications and good resolution in long term due the absence of symptoms in most patients.

Keywords: Advanced achalasia, Chagasic megaesophagus, Esophageal achalasia, Esophageal mucosectomy, Esophagectomy

1. Introduction

Achalasia is one of the most studied affections associated with esophageal motility and is characterized by incomplete relaxation of the lower esophageal sphincter and absence of peristalsis along the esophageal body. Consequently, the food transit towards the stomach becomes hampered, which makes the patient present dysphagia as the main symptom. Other symptoms such as regurgitation of saliva and undigested food, heartburn, chest pain and respiratory symptoms such as nocturnal cough, recurrent aspiration and pneumonia have also been reported [1, 2].

The incidence of achalasia is similar in most countries, ranging from 0.7 to 1.6 per 100,000 inhabitants/year and with a prevalence of 1.8 to 12.6 per 100,000 inhabitants [2, 3].

Although idiopathic achalasia and Chagas disease have different etiologies, both conditions have, in fact, the same clinical, radiological, endoscopic and manometric presentation [1–3].

2. Achalasia therapeutics

Different methods have been proposed for the treatment of this condition, none of which seems to be optimal, as they do not act directly on the pathophysiology of the disease [1, 4, 5]. Thus, the main objective this disease treatment is to rescue swallowing and diagnose potential diseases that may occur in the dilated esophagus, consequent to long lasting food stasis.

Extramucosal cardiomyotomy, with its different technical variants, remains the most widely used surgical procedure, and with the advent of minimally invasive surgery today, the endoscopic (POEM) or laparoscopic approach has been widely accepted [2–7].

The good results obtained in myotomy using the minimally invasive technique are for cases of non-advanced achalasia, corresponding to an esophageal diameter that does not exceed 6 cm and that in high-resolution manometry reveals type II Chicago classification [2–4]. This has recently been well demonstrated in a meta-analysis involving 1575 patients with achalasia type II, submitted to laparoscopic myotomy with fundoplication with medium and long-term follow-up, that demonstrated a success rate with adequate rescue of swallowing in 92% of patients [8]. These results confirm what has been previously demonstrated by other authors who made assessments 1 to 18 years after surgery, in a compilation of 39 series with 3,086 patients with non-advanced achalasia undergoing this surgical procedure, who presented an average of 89% of excellent results [9].

Although laparoscopic myotomy is considered the first-line treatment for non-advanced achalasia, it is an invasive procedure though, that requires general anesthesia, which can lead to greater morbidity in the immediate postoperative period, especially in patients with unsatisfactory cardiopulmonary clinical conditions [2, 4, 10].

This is the reason for the advent of endoscopic myotomy, a procedure described by the Japanese school, and which consists, in the realization, under endoscopic vision, of a long extension submucosal tunnel from the end of the middle esophagus to 2 cm below the columnar squamous junction, in order to expose and section more adequately the esophagus circular muscle fibers [11]. The great advantage of this procedure is to minimize the surgical trauma that can potentially occur with more intensity through the laparoscopic approach [2–4, 12].

Some series have shown in a mean 3-year follow-up after surgery that endoscopic myotomy is comparable in terms of good results to 87 to 93% with the laparoscopic route results when evaluated by the ECKARDT score, thus providing good quality of life in patients with non-advanced achalasia [4, 13–16].

Although endoscopic myotomy has the advantage of avoiding further surgical trauma, in an evaluation carried out in the medium and long term, it has been shown, however, that endoscopic myotomy predisposes to greater gastroesophageal reflux when compared to laparoscopic myotomy, since in the latter a partial fundoplication surgery is performed. This has recently been shown in meta-analysis studies with pH monitoring. It was found that the rate of acid exposure can range from 39 to 58% after endoscopic myotomy decreasing to only 7.6% to 16.8% when compared to surgical myotomy [17, 18].

Although surgical/endoscopic myotomy demonstrates good results in the adequate rescue of swallowing in patients with non-advanced achalasia, this is not evidenced though in patients who have this condition with an esophagus diameter greater than 6 cm and in high-resolution manometry having a type I Chicago classification, due to the lack of adequate contractility of the entire esophagus, as has been shown recently [2–4].

Thus, other authors began to standardize cardioplasty procedures for patients with advanced achalasia, in order to promote a more adequate esophageal emptying, mainly by the techniques described by Thal et al., 1965, Hatafuku et al. in 1972, and Serra Doria et al. in 1968, with the experience of the Brazilian surgical school being outstanding, since in this country, advanced achalasia is quite frequent, due to the predominance of the Chagas etiology [19–22].

However, mid-term studies have shown that cardioplasties have not always yielded satisfactory results, mainly due to the difficulty in emptying the esophagus, and due to the gastroesophageal reflux that such procedure can trigger [20, 22–24]. This fact has been well demonstrated more recently by Aquino et al. [25], who evaluated the 5 years late postoperative period in 19 patients with recurrent advanced achalasia who underwent SERRA DORIA cardioplasty and found that only 38.4% of the patients had normal swallowing and 53.8% of them had regurgitation, concluding that this procedure should only be indicated for patients without clinical conditions justifying esophagectomy.

Based on these considerations, the almost total resection of the esophagus began to acquire a new perspective for the treatment of major achalasia, Camara-Lopes [26], concerned with the poor results of conservative therapy for cases of advanced achalasia of Chagas disease etiology, introduced in Brazil in 1958, the subtotal resection of the esophagus via the right transpleural approach. At the same time, he further recommended that the reconstruction of the transit would be performed in a second surgical stage, through a retrosternal gastroplasty, a surgery that became known after his name.

With the best standardization of this procedure, it was recommended that this surgery be performed at the same time, with the gastric transposition to the cervical region performed by the posterior transmediastinal route, demonstrating the advantages of this technical variant over the previous one, mainly because it leaves the stomach in the space previously occupied by the esophagus, preventing the angulation of the esophagogastric anastomosis; in addition two operative times are avoided, which could cause greater morbidity [27–29].

Although the subtotal esophagus resection could offer the advantage of trying to completely resolve the dysphagia, by removing the entire denervated area of the organ, with great ectasia, it still caused high morbidity [28–30].

Thus, many authors began to indicate more economical resections, acting exclusively in the esophagus distal third section and in the cardia, locations of greatest importance within the achalasia pathophysiology, due to the evident lack of relaxation at the level of the lower esophageal sphincter. Hence, they recommended the distal resection of the organ or simple cardiectomy, either by left thoracolaparotomy, or laparotomy, reconstructing the transit, either by interposition of a jejunal loop [31–33], or with a colon segment [33, 34] or by means of a valved or non-valved intrathoracic esophagogastric anastomosis [33, 35]. However, mid- and long-term postoperative evaluation with distal esophageal resection showed relapse of dysphagia or gastroesophageal reflux in a significant percentage [31, 32, 34].

Thus, the evaluation, carried out both in anatomical and functional studies, demonstrated with more precision that subtotal esophagectomy was the procedure that was even better suited for the treatment of advanced forms of megaesophagus, despite the great extension of the surgery [36, 37]. In turn, patients with advanced disease, usually malnourished and with difficulty in emptying the esophagus, were predisposed to repeated bronchoaspirations, and may present a significant degree of pulmonary impairment, which causes the transpleural pathway to be predisposed to severe postoperative complications, especially in the pulmonary functions [30, 32, 38].

In the past, the persistence of great surgeons in trying to solve the problem of pulmonary collapse and pleuromediastinal contamination in cases of esophageal cancer led to the recommendation of successful esophagectomy via the cervicoabdominal extrapleural route, in experimental and clinical studies [39].

Based on this experience and always concerned with the obstacle of thoracotomy, over the years, several authors began to indicate esophagectomy without thoracotomy in a rationalized way, in patients with esophagus, cardia or pharyngoesophageal transition malignancy, or even in the case of esophageal stricture, consequence of caustic esophagitis or gastroesophageal reflux [40–44].

Considering that the results were quite favorable, the possibility of performing it for cases of advanced megaesophagus began to be considered. Ferreira [45], seeking to adapt the advantages of subtotal esophagectomy, through a less traumatic technique, especially for patients with severe esophageal ectasia, potentially malnourished and sometimes with pulmonary affections introduced in Brazil cervicoabdominal esophagectomy without thoracotomy, the phleboextraction method, with transit reconstruction through an esophagogastroplasty through the posterior mediastinum, a technique that became known after its author's name.

Thus, with the better standardization of this surgical technique, several authors from the Brazilian surgical school started to use this procedure as a routine in the treatment of advanced megaesophagus [46–49]. Others advocated the resection of the esophagus through the same route, but by rhombodigital mediastinal dissection and detachment [44, 50].

Pinotti [41] and Pinotti et al. [51], improving the evaluation of both procedures, emphasized that they did not provide an adequate approach of the esophagus, and its resection was carried out practically "blindly". Thus, also wanting to avoid the obstacle of thoracotomy, but to provide a wide view of the organ at the mediastinal level for its resection, he proposed a wide frenotomy in the middle portion of the diaphragm, from the esophageal hiatus to the xiphoid appendix. Thus, for more advanced cases of achalasia, a more rationalized technique through the cervicoabdominal approach was deemed suitable. From then on, this technique became known after the name of the author, and was used by other surgeons [49, 50, 52–54].

More recently, with the advent of minimally invasive surgery, resection of the esophagus has been made possible using video laparoscopy [55–57].

Although the resection of the esophagus without thoracotomy, using any of the three technical variations mentioned, could bring the advantages of avoiding the impairment of pulmonary dynamics, such surgery has not been shown to be completely free from complications. Among these, there is the opening of the pleura and consequent hemo or hydropneumothorax, causing greater postoperative morbidity [46, 50, 51, 53, 58]. This can occur, as advanced esophageal achalasia, due to periesophagitis, causes the esophagus to be adhered to the noble structures of the mediastinum and thus during the dissection procedures it may predispose to lesions.

In addition, it is well known that in advanced megaesophagus, stasis esophagitis, which is usually present, predisposes to the development of preneoplastic lesions, such as leukoplakia, and may even progress to malignancy [3, 4, 23, 59, 60].

In view of these considerations, a method was devised that would allow the removal of the esophagus mucosa and submucosa through the esophagus complete invagination, through the combined cervicoabdominal route without thoracotomy and preserving the entire esophageal muscle tunic. Thus, prophylaxis will be performed with the eradication of preneoplastic mucosal lesions that might exist. In addition dissection and detachment of the esophagus at the level of the mediastinum is avoided.

3. Esophageal mucosectomy - historical aspects and indications

The idea of removing the esophageal mucosa and submucosa by invagination, preserving the tunica muscle at the mediastinal level, dates back to 1914 with the pioneering works of Rehn (apud Kirschner [61]). This author, concerned at the time with mediastinal hemorrhages and pleural lesions which occurred in the case of esophageal stripping via the cervical abdominal route in experimental surgery in dogs, conceived the experimental model by extracting only the mucosal and submucosal cylinders through the same route. However, due to the low impact of his method and for not being able to standardize an adequate reconstruction of the cervical esophagus with the stomach, he abandoned his propositions.

Later, other authors demonstrated, in clinical experience, the validity of this procedure in patients with caustic esophagitis, carcinoma of the distal esophagus and of the proximal portion of the stomach [62, 63].

As Brazil is a country with a high incidence of achalasia, mainly due to Chagas etiology, Aquino et al. [64] recommended this type of procedure, initially carrying out an experimental study in dogs, demonstrating its feasibility. Further studies on human cadavers demonstrated the feasibility of this method.

Thus, supported by this experimental verification, our clinical experience began with good evolution in the initial evaluation [65], and recently the great validity of this procedure was demonstrated in 131 patients with advanced achalasia with esophageal diameter greater than 10 cm.

4. Methods – surgical technique: esophageal mucosectomy

Surgical technique following standardization proposed by Aquino [65]:

a. Mucosal resection - Abdominal stage: The surgery starts with a midline laparotomy from the xiphoid process to 5 cm below the umbilicus followed by dissection of the abdominal esophagus and division of vagi nerves. Longitudinal myotomy in the anterior esophagus from the cardia to the hiatus and circumferential dissection of the mucosa/submucosa layer in 5 to 7 cm (**Figure 1**).

   Cervical stage: Left lateral cervicotomy following the anterior border of the sternocleidomastoid muscle from the sternum to 10 cm upwards. Dissection of the esophagus free of the posterior and prevertebral fascia and trachea. Longitudinal myotomy in the anterior esophagus 5 cm from the pharynx to the sternum and circunferencial dissection of the mucosa/submucosa layer. (**Figure 2**).

   Combined stage: After a cylindrical segment of mucosa is dissected free of the muscular in the abdomen and neck, a small mucosectomy is made in the abdomen and neck to allow the passage of a rectal tube upwards. Cervical esophageal mucosa is circumferentially transected and tied to the rectal tube by a long and resistant surgical thread to allow pulling the replacement viscera to the neck. The mucosa is slowly striped downwards and inverted in the abdomen. (**Figures 3** and **4**). The esophagus is completely sectioned at the level of the esophagogastric junction and the neck.

b. Digestive Tract Reconstruction: Digestive tract was reconstructed in all patients with the stomach after division of the left side gastric, right gastroeplicoic and

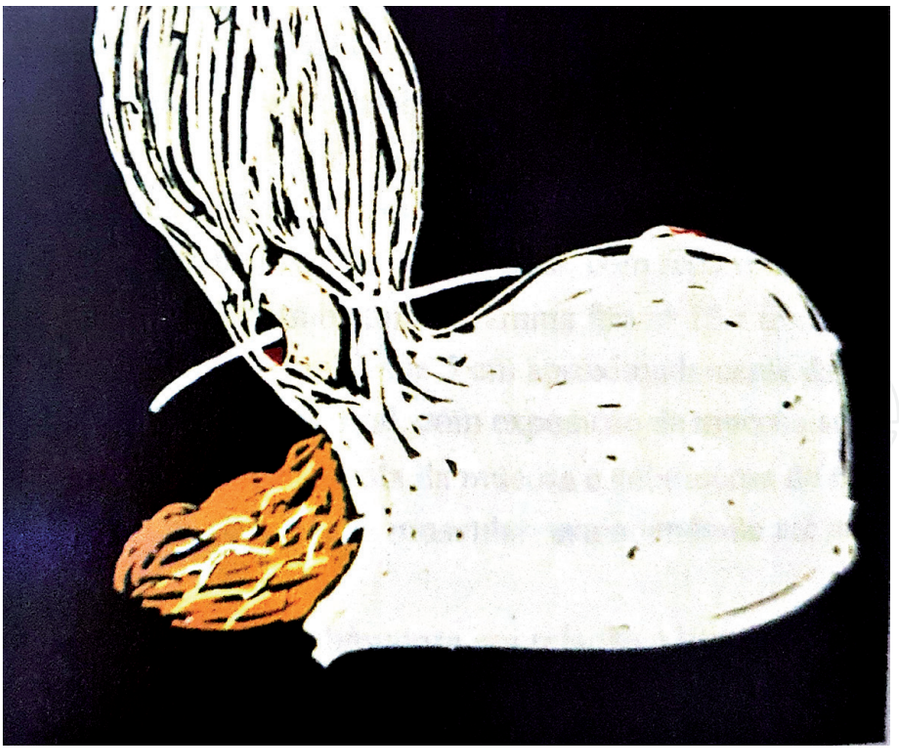

Figure 1.
Abdominal stage-circunferencial dissection of the mucosa/submucosa layer.

Figure 2.
Cervical stage-circunferencial dissection of the mucosa/submucosa layer.

short vessels. A route for stomach transposition on accessibility to the neck in all patients was into the muscular tunnel (**Figure 5**). Esophagogastrostomy anastomosis was performed at the cervical level too in all patients with a circular stapler for end-to-side anastomosis. A feeding jejunostomy tube was always added to the procedure. Drains were left in the abdomen and neck.

4.1 Early postoperative evaluation

This assessment was performed with 131 patients with advanced achalasia undergoing this type of surgical procedure. The patients remained in the first

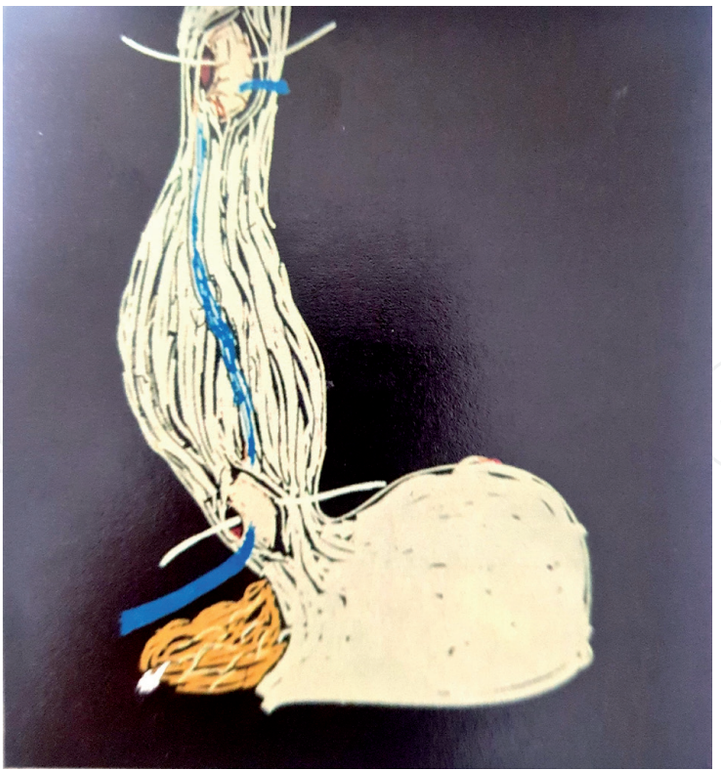

Figure 3.
Cervical esophageal mucosa is transected and tied.

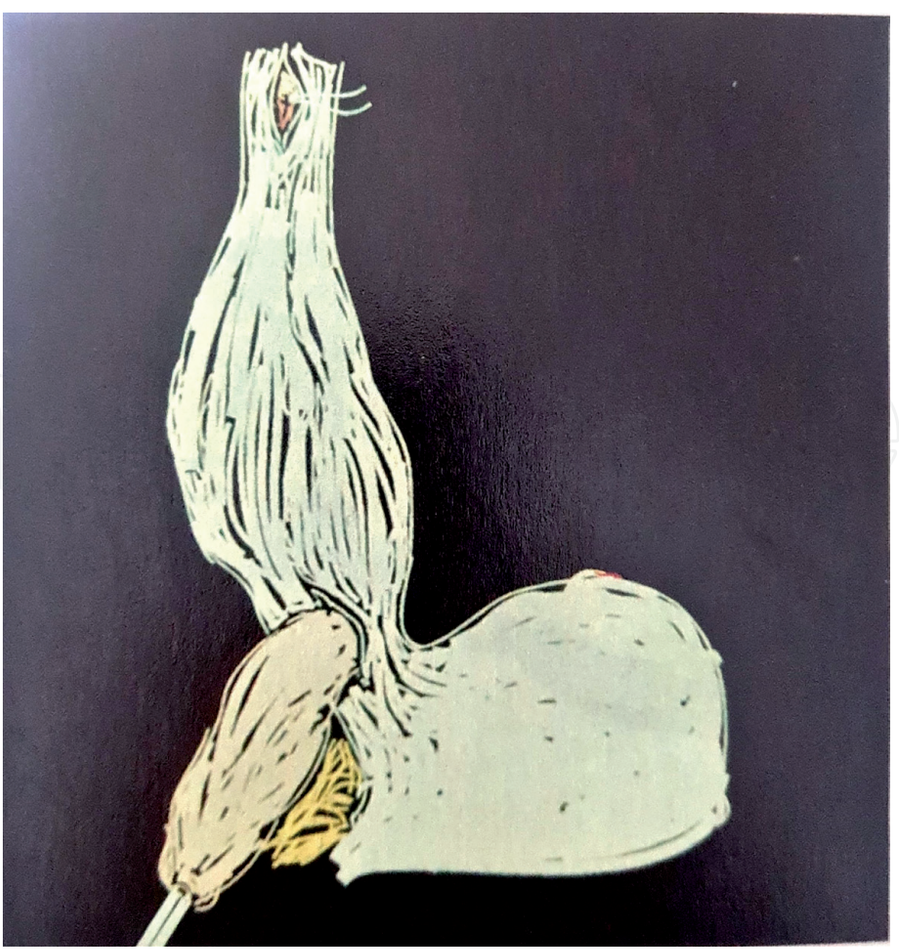

Figure 4.
The mucosa is slowly stripped downwards and inverted in the abdomen.

Figure 5.
Gastric transpositon to the neck into the muscular tunnel.

24–48 hours after surgery under the care of the medical team of the Intensive Care Unit, and enteral nutrition was started through the jejunostomy tube, with the reestablishment of intestinal motility.

Oral feedback was instituted after evaluating the integrity of the esophagogastric anastomosis by performing contrast radiography with iodinated substance between the seventh and the tenth postoperative day; in patients with clinical evidence of fistula, depending on its evolution; the day of this examination was variable.

In all patients, a simple chest X-ray was performed in the first 24 hours after surgery and systematically repeated at a 72-hour interval in the first week, or for a shorter period in cases with clinical parameters of pleuropulmonary complications.

The entire sample was initially assessed in terms of morbidity and mortality in the first thirty days after surgery, as well as the treatment for each of the complications.

4.2 Late postoperative evaluation

This assessment was carried out in 85 patients with a variable period of 2 to 5 years after the surgery, and was compared with the preoperative period. The four main clinical symptoms and their intensity was quantified according to the score proposed by Eckardt et al. [66]: (a) DYSPHAGIA: zero - no symptoms; 1- occasional; 2 - daily; 3 - every meal; (b) REGUGITATION: zero - no symptoms; 1- occasional; 2- daily; 3 - every meal; (c) RETROSTERNAL PAIN: zero - no symptoms; 1 - occasional; 2 - daily; 3 - several times a day; WEIGHT LOSS: zero - no loss; 1- <5 kg; 2–5 to 10 kg; 3- > 10 kg.

5. Results

5.1 Early assessment

1. Aspects related to mucosal resection: Mucosal resection by means of submucosal detachment was performed easily and without accidents in all 131 patients, with the removal of the entire circumference of that tunic.

2. Anatomopathological evaluation: In all surgical samples studied, there was moderate to intense lymphoplasmacytic infiltrate, both in the mucosal and submucosal layers. In 17 surgical specimens (12.9%), leukoplastic lesions were present, but none of them showed malignancy.

3. Clinical evaluation: out of the 131 patients studied, 129 (98.4%) had good evolution without any hemodynamic changes, being discharged from the Intensive Care Unit within the first 48 hours after surgery. Oral diet started between the 7th and 10th postoperative day in 107 patients (83.0%), after confirmation of the integrity of the cervical esophagogastric anastomosis by the esophagram. The jejunostomy tube was removed after 3 to 4 weeks postoperatively when solid diet was introduced orally. In 22 patients (17.0%), due to anastomotic dehiscence, the oral diet was reintroduced between the 18th and 29th day after surgery, after clinical and radiological confirmation of the closure of the anastomotic dehiscence.

4. Chest radiological evaluation: Simple chest radiography performed postoperatively on the recommended days did not reveal any pleuropulmonary alteration in 113 patients (86.2%). In the remaining ones, isolated pleural effusion was evidenced in 11 patients (8.3%), pulmonary infiltrate only in 5 patients (3.8%) and association of pleural effusion and pulmonary infiltrate in 2 patients (1.5%).

5. Complications – Two patients (1.5%) died on the third and fifth postoperative days, for sepsis due to stomach necrosis and pulmonary embolism, respectively. Chest drainage was performed in 7 of the 11 patients who presented with moderate pleural effusion, with expectant management for the remaining 4 patients and with good outcome. Pulmonary infection diagnosed in 7 patients (7.6%) was treated with specific medication and with good evolution. Anastomotic dehiscence present in 22 patients had good resolution with conservative treatment. Of these, 9 patients had anastomotic stenosis, with good improvement after endoscopic dilation.

Symptoms	**N = 85 patients**		
	Preoperative	**Postoperative (2 to 5 years)**	*p*
Dysphagia	2.7	0.9	<0.001
Regurgitation	2.1	0.8	0.043
Retrosternal pain	1.9	0.2	0.049
Weight loss	2.9	0.0	0.001
Total	9.6	1.9	0.009

Table 1.
Distribution of patients in the pre- and postoperative period in relation to the mean of symptoms according to the Eckardt score et al. [66].

5.2 Late assessment

It was performed in 85 patients between 2 and 5 years after the surgery in relation to the average of the four symptoms recommended by the Ekardt et al. score [66], A significant difference between the pre- and postoperative periods was observed during the time studied, showing that the patients experienced a good evolution (**Table 1**). And also when taking the mean of the sum of symptoms, the difference was also very significant, because preoperatively the mean score was 9.6 and postoperatively it decreased to 1.9 (**Table 1**).

6. Comments

Most of the time, the few authors who described the clinical experience of removal of the mucosa and submucosa of the esophagus by invagination with preservation of the muscular tunic performed median frenotomy with section of the diaphragmatic pillar for greater exposure of the esophagus, and thus to be able to dissect the mucosa in greater detail extension [62, 63].

Opening the diaphragm with greater esophageal dissection at the mediastinal level would not correspond to one of the objectives recommended by the technique we propose: to avoid mediastinal involvement. Thus, in no patient in the series studied, this exposure became necessary, since the dissection of the mucosa in relation to the tunica muscularis, performed along the entire length of the abdominal esophagus and in almost the entire length of the cervical esophagus, was sufficient for the removal of the specimen with the surgical procedure in all the cases studied, according to intraoperative macroscopic evaluation.

This easy removal of the mucosa through the submucosal plane must occur due to the histological characteristics of the esophagus tunics. The mucosa consists of a resistant stratified flat epithelium, and the submucosa has a low proportion of collagen fibers and a large amount of elastic fibers, making it more flexible and looser [62].

Another objective of this procedure is that in the entire resection of the mucosal/submucosal cylinder, both the prophylaxis and the eradication of all chronic inflammatory lesions detected due to the long-term food stasis and, as a consequence, a malignant potential, have occurred as has been shown in some series of patients with advanced megaesophagus, with a frequency ranging from 3–10% [3, 27, 49, 50]. The presence of carcinoma was not found in any of the samples, although in all cases, there was moderate to intense inflammatory infiltrate and in 12.9% leukoplastic lesions.

Mediastinal hemorrhage is not a common occurrence after esophagectomy without thoracotomy. However, a high incidence of morbidity and mortality is expected when hemorrhage occurs [29, 33, 42, 44]. This can occur due to direct injury to the azygos vein and esophageal vessels directly from the aorta, which associated with pleural involvement can progress to hemothorax in up to 25% of cases. This complication usually requires immediate repair by thoracotomy, often unsuccessfully, a fact that did not occur in any of the cases of esophageal mucosectomy technique surgeries used.

Another complication that can occur with transhiatal esophagectomy is hydropneumothorax with an index variable from 22.2% to 83.3%, because the dissection of the esophagus at the mediastinal level can result in the opening of the pleura [29, 33, 42, 44–46]. The reduced incidence of pleuropulmonary complications and none at the mediastinal level in the series of patients in our study, justifies once again the proposed technical procedure.

Recently, Aquino et al. [67] compared intra- and postoperative complications in 229 patients with advanced megaesophagus undergoing esophageal mucosectomy and transhiatal esophagectomy. Pleural effusion with or without hemothorax was more frequent in patients submitted to transhiatal. Other complications of great morbidity occurred only in the group submitted to transhiatal, like massive hemothorax which developed in 6 (5%) patients, among which two died. Also in the transhiatal groups, 3 (2%) patients developed tracheal injury and one of them died.

Another important aspect to consider with this technique is the possibility of excessive bleeding when removing the mucosa and submucosa. However, both in the intra- and immediate postoperative evaluation, all parameters showed that the patients evolved hemodynamically stable and few required blood replacement. Paricio et al. [62] demonstrated in their series that the amount of blood did not exceed 100 mL by aspiration drainage from the tunica muscularis in 3 patients who had undergone mucosectomy due to adenocarcinoma of the cardia. Other authors who also performed this technique demonstrated that although the mean blood volume eliminated intraoperatively was between 700 to 800 mL, in none of the patients hemodynamic instability developed [63]. Aquino et al. [64], demonstrated in an experimental study in dogs, absence of active bleeding 2 hours after mucosectomy.

These findings confirming the minor bleeding with the use of the technique described above may be due to the characteristics of the esophagus intramural blood supply. According to Potter & Holyoke [68], the segmental arterial branches of the aorta penetrate the longitudinal and circular muscle bundles of the esophageal wall and further subdivide into the highly distensible tunica submucosa. Thus since these vessels have a much narrower caliber than the esophagus arteries it is supposed that spontaneous hemostasis occurs.

In the late evaluation of the 85 patients whom we were able to follow-up up for 5 years, the validity of said operative procedure was evidenced once again, because, as demonstrated, the four symptoms recommended by Eckardt et al. score [66] had an evident significance between the pre- and post-operative period with good evolution of the patients. Dysphagia stands out, which in the preoperative period all patients exhibited this symptom daily and/or at every meal and in the postoperative period, the majority had normal swallowing or very occasional dysphagia. In addition, all patients experienced a very expressive weight gain with 27 patients exhibiting more than 25 kg of weight gain.

And also when we evaluated the mean sum of symptoms at the same time of follow-up, the good evolution of the patients was once again confirmed, as preoperatively it was 9.6 and post-operatively it decreased significantly to 1.9.

Until the presentation of our study, no series had demonstrated any study that could compare in the preoperative and postoperative esophagectomy period performed for advanced achalasia of chagasic or idiopathic origin, the assessment of the sum of the symptom score proposed by Eckardt et al. [66]. Only this author's study is reported with 54 patients with idiopathic achalasia, but who underwent pneumatic dilation with a mean follow-up of 13.8 years after the procedure. These authors recommended that in order to have clinical remission of the disease after treatment, it is necessary that the symptoms have completely disappeared or that the total sum of the score does not exceed 3, a fact that was very evident in our series.

Thus, we conclude that esophageal mucosectomy with preservation of the muscular tunic for the treatment of advanced esophageal achalasia is an adequate procedure due to the low incidence of pleuropulmonary complications, absence of mediastinal complications and good resolution of symptoms in the long term. We thus hope to offer a new alternative for those who consider the esophagus resectability as the best form of therapy for advanced achalasia.

Acknowledgements

To Hospital Puc-Campinas.

Conflict of interest

The authors declare no conflict of interest.

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