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Original Article

Surgical Treatment of Esophageal Cancer by Videosurgery: Standardized Technique for Prone Thoracoscopy and Laparoscopy

Tratamento Cirúrgico do Câncer de Esôfago por Videocirurgia: Padronização Técnica por Toracoscopia em Prona e Laparoscopia

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ABSTRACT

This article reports the Barretos Cancer Hospital experience treating esophageal cancer by videosurgery. The transmediastinal and transthoracic approach – the latter in the prone position first reported by Cadière – are described in detail. Following a brief literature review, this series reports 83 cases operated from 2009 to 2012, emphasizing the laparoscopic techniques, the indications for each technique, as well as the sequence of steps that are followed when using this treatment modality.

Key words: Videosurgery. Esophagectomy. Thoracoscopy. Transhiatal esophagectomy.

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INTRODUCTION

The treatment of esophageal cancer is increasingly carried out by video-endoscopic surgery, whether by a transmediastinal approach, or by combining laparoscopy, thoracoscopy, and intrathoracic or cervical anastomoses. The laparoscopic approach has the advantage of offering the surgeon a wide field of view, which enables the surgeon to dissect the esophagus and surrounding structures with absolute safety, as well as perform a full lymphadenectomy, including the intrathoracic lymph nodes and the lymph nodes of the celiac trunk.

In a cases series of 222 patients with esophageal adenocarcinoma who underwent laparoscopy and thoracoscopy with cervical anastomosis Luketich et al., reported that mortality was 1.4%, anastomotic dehiscence 11%, and respiratory complications, mainly pneumonia, 7.7%, which constitute excellent results, outcomes superior to open surgery. (1)

One should take into account, however, that the patients in this series are different from those found in our midst, who usually present with more advanced stage tumors, the vast majority unresectable, many with nutritional deficits so severe (weight loss often exceeding 30%), that some are unable to even tolerate palliative treatment. (1)

The same investigators published another analysis with a smaller number of patients (n=50) who had undergone intrathoracic anastomosis; there was a lower incidence of fistulas, 6%, but a higher mortality rate, 6%.(1) The fistulas, which were intrathoracic, were evidently more serious, explaining the higher mortality and a rate of pneumonia almost comparable to the 8% rate of the previous cohort. In a 2008 prospective study with 104 patients undergoing minimally invasive surgery, Nguyen et al. also demonstrated good results, suggesting that laparoscopic esophagectomy is a feasible, safe procedure with acceptable morbidity and mortality. (2)

MATERIALS AND METHODS

Esophagectomies have been performed at Barretos Cancer Hospital since 2009 through a transmediastinal approach with cervical anastomosis with dissection of the celiac trunk and periesophageal

lymph nodes, or the combination of thoracoscopy and laparoscopy, with lymph node dissection of the celiac trunk, periesophageal and subcarinal lymph nodes, depending on the location of the tumor.

The first technique is indicated for tumors of the lower third of the esophagus, in patients who are debilitated, but whose performance scores suggest they are still candidates for surgery. The second technique is indicated for tumors of the middle third of the esophagus or for younger patients in good general health who can tolerate a longer and more aggressive surgery. Lymphadenectomy in three fields (mediastinum, celiac trunk and cervical), may also be indicated in selected cases, especially for tumors higher in the esophagus.

When we employ the transmediastinal approach, the patient is positioned supine, bolstered with cushions at the level of the xiphoid process and shoulders. When we employ the combined approach, we first perform a thoracoscopy through which the entire thoracic esophagus is freed and the periesophageal and subcarinal lymph node chains are resected. The patient is then in placed in the prone position as described by Cadière and collegues,(3) bolstered with cushions and tilted slightly to the left. The lung falls posteriorly and out of the field of interest, which facilitates visualization of the esophagus and mediastinal structures. Occasional bleeding does not obscure the visual field, because the camera is always above it.

The surgical specimen is withdrawn through an umbilical trocar incision enlarged to a 4 cm "W" shaped incision, protected by a wound guard. The intracavitary stapling is done laparoscopically. The surgical specimens of early stage upper esophageal tumors without lymph node involvement can also be removed through the cervical region. The cervical anastomosis is made with a 21mm circular stapler.

TRANSMEDIASTINAL ESOPHAGECTOMY: SURGICAL TECHNIQUE

We present a description of esophagectomy for the treatment of distal esophageal tumors using a laparoscopic and transmediastinal approach. The technique involves preparation of the stomach, creation of an intra-abdominal gastric tube, and left cervicotomy so that the esophagogastric anastomosis and lymphadenectomy of the celiac trunk can be performed.

The patient is placed in lithotomy position with the legs – supported in appropriate leggings – extended and separated. The surgeon stands between the legs, with the assistants to the left of the patient. Six ports are used: A. 11 mm trocar with a 10 mm optic at 30 degrees just above the umbilicus, approximately 15 cm from the xiphoid process; B and C: 12 mm trocars in the left and right flanks, in the mid-clavicular line (these are the working ports of the surgeon); D and E: 12 mm trocars in the right and left hypochondria, a little more medial and cephalic to facilitate access to the mediastinum; E: 5 mm trocar in the midline subxiphoid (for the retractor).

With the pneumoperitoneum pressure at 12 mmHg, the procedure is initiated with the opening of the phrenoesophageal membrane and the greater omentum, which provides access to the right branch of the right diaphragmatic pillar. From this point the peri-esophageal tissue around the terminal esophagus is released, isolating the esophagus by dissecting the esophagogastric transition while securing the abdominal esophagus with a Penrose drain or flexible retractor (Endo-Flex GmbH**,** Voerde, Germany). Celiac lymphadenectomy is performed during this approach (Figure 1).

At this point, the surgeon proceeds to the dissection, under direct visualization, of the body of the esophagus, being careful to identify the pleura, pericardium, azygos vein and vagal trunks across the entire breadth of thorax (Figure 2).

Hemostasis is achieved with monopolar cautery and/or clipping of larger esophageal branches or, preferably, with the use of an ultrasonic scalpel. For better access to the mediastinum during the dissection of the thoracic esophagus, a median transection of the diaphragm is performed (Figure 3).

After complete dissection of the abdominal and thoracic esophagus, the stomach is prepared by mobilizing its greater curvature. Monopolar or bipolar electrocautery can be used, or preferably, an ultrasonic scalpel or LigaSuture Atlas to section short vessels and the gastrocolic omentum, taking care not to damage the greater curvature arterial arcade.

Double clipping is used to ligate the left gastroepiploic and left gastric arteries and veins; the right gastroepiploic artery is preserved to supply the arcade of the greater curvature. Pyloroplasty is not performed. The preparation of the stomach is completed by creating an intra-abdominal tube (Figu-

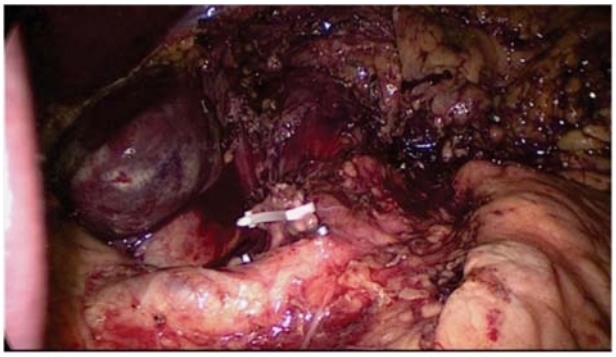

Figure 1 – *Lymphadenectomy of the celiac trunk, 11p chain, and left gastric artery sectioned with clips.*

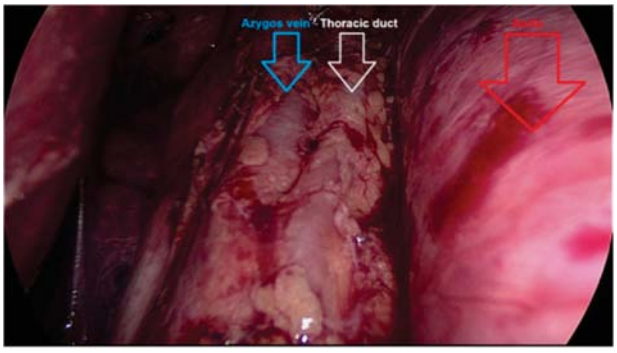

Figure 2 – *Dissection with mediastinal lymphadenectomy; arrows identify the azygos vein, thoracic duct and aorta.*

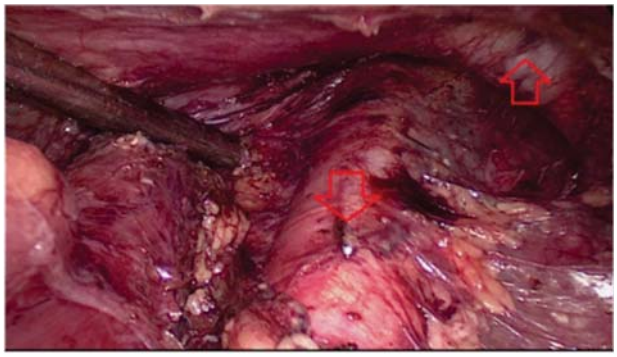

Figure 3 – *Thoracic esophagus dissected and pulled aside by suction. The red arrows point to the aorta and pericardium superiorly.*

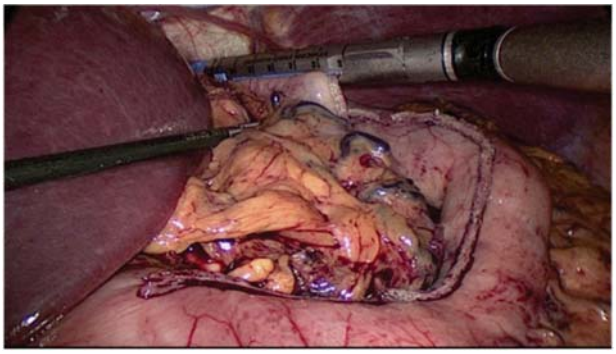

Figure 4 – *Creating the intra-corporeal gastric tube using with a linear cartridge; typically six 60 mm blue cartridges are required. Starting 4 cm from the pylorus, the gastric tube has a diameter of 3 to 4 cm and is 30 to 35 cm in length.*

re 4) with a laparoscopic blue cartridge linear stapler. The surgical specimen is removed through a small "W" shaped umbilical laparotomy.

Dissection of the cervical esophagus and the upper thoracic esophagus is performed through a left neck incision by blunt dissection, with attention to isolating the left recurrent laryngeal nerve. We proceed to esophageal transection using a purse string forceps, transfixing the distal esophageal stump with 0-vicryl. At this point, we afix cardiac tape to the esophageal stump in order to draw the gastric tube to the cervical region, where the mechanical anastomosis is closed using a 21 mm circular stapler. The passage of the gastric "tube" through the mediastinum is observed under direct vision by positioning the optic in the lower mediastinum.

A nasogastric tube is positioned below the cervical anastomosis, in the duodenum when possible, or in the jejunostomy in cases of doubtful anastomoses, or high risk patients such as those with Chronic Obstructive Pulmonary Disease or those recovering after radiation therapy and/or chemotherapy. We employ cervical and abdominal drainage. The esophagogastric tube anastomosis should be kept in the cervical region. This placement avoids gastric fluid reflux into the esophagus and thus consequent esophagitis. By not having the anastomosis in an intrathoracic position, fistual-related mediastinitis is avoided. Cervical fistulas, should they occur, are easier to treat with drainage where the pressure is positive.

We routinely drain the chest, with radiographic control, postoperatively. The lymphadenectomy, and the number of lymph nodes dissected, are similar to the conventional technique (Figure 5). We found that the laparoscopic technique is safe and has excellent postoperative results (Figure 6).

ESOPHAGECTOMY BY THORACOSCOPY AND LAPAROSCOPY

We used thoracoscopic access for tumors in the proximal and middle thirds of the thoracic esophagus, to facilitate dissection of the esophagus and mediastinal lymph nodes, and because it is the

best oncologic practice in these cases. The laparoscopy, which follows, is performed as described above with preparation of the stomach and lymphadenectomy of the celiac trunk and cervical lymph node chains 1 and 3, with creation of an intracorporeal gastric tube, and the left posterior cervicotomy in order to perform the esophagogastric anastomosis.

For the thoracoscopy, the patient is placed in the prone position bolstered with a large cushion under the chest which is tilted slightly to the left side to optimize the ergonomics and, in the case of complications, to facilitate a thoracotomy (Figure 7).

The procedure begins with the introduction of four trocars: one 11 mm and three 5 mm. A 12 mm trocar may be used, so that the azygos vein can be ligated with a vascular stapler. Mini-laparoscopic trocars or conventional trocars used in laparoscopies can be used in the chest wall; we do not use special trocars designed for the chest. We used low volume CO_2 at 8 mmHg to maintain the lung collapsed and to minimize minor bleeding during dissection. The position of the ports is just below the angle of the scapula forming a diamond (Figure 8).

It is common for patients who are smokers or have a history of a pulmonary infection to have pleural adhesions. The right lung is "collapsed" with an appropriate retractor, while the left lung receives selective mechanical ventilation. The dissection of the pleura is carried out close to the esophagus upwardly with dissection and ligation of the azygos vein using sutures, metal clips, Hemolock, and/or a vascular stapler (Figure 9).

The esophagus is completely dissected – with mediastinal, periesophageal, supra and subcarinal lymphadenectomy and posterior dissection of the pulmonary veins (Figure 10) – until the distal esophagus

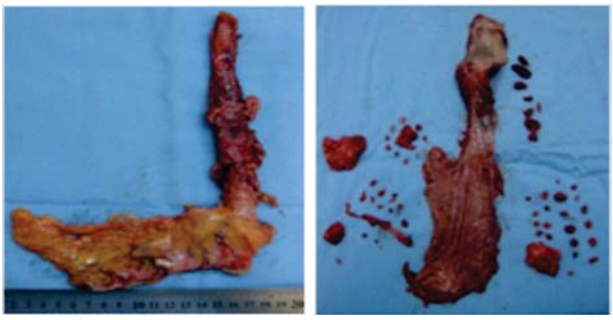

Figure 5 (A) – *Closed surgical specimen from the esophagectomy.* ***(B)*** *– Surgical specimen opened in the operating suite with the lymph node dissection organized into chains.*

Figure 6 (A) – *Final result of a transhiatal esophagectomy, with left neck incision. (B) – Final result of an esophagectomy carried out in three fields (thoracoscopy, laparoscopy and bilateral neck incision).*

Figure 7 – *Patient in the prone position, with a large cushion placed under the chest.*

Figure 8 – *Left: Patient in ventral position, using mini-forceps on the superior ports. Right: the four thoracoscopy incisions, with a chest tube in the mid-axillary line.*

is reached near the diaphragmatic pillars. The thoracic duct is ligated inferiorly with metal clips.

There are critical points that require caution during dissection of the esophagus: the underside of the esophagus (to avoid injuring the atrium), the trachea just above the carina, and the right and left main bronchi. Close to the spine, along the course of the azygos vein, be wary of the thoracic duct, because it should not be in the surgical specimen, as part of lymphadenectomy (Figure 11).

The chest tube is placed under direct vision through a counter opening below the optic trocar, in the right mid-clavicular line. The trocar orifice is not used – because it is extremely posterior and postoperatively has a risk of bending – to avoid such complications. The patient is repositioned in the lithotomy (prone) position to prepare the abdominal phase by laparoscopy, which is similar to the phase described for the transhiatal esophagectomy. The thoracic phase is safe, with an average duration of one hour.

CONCLUSION

Our case series included 83 transhiatal and thoracoscopic esophagectomies performed over a three year period; the surgeries were entirely laparoscopic. We had a high proportion of advanced tumors, an operative mortality rate of 5%, an incidence rate of "benign" cervical fistulas of 15%, and conversion rate of 2.4%.

In this series, five cases of esophagogastrectomies for advanced tumors of the cardia with invasion of the distal esophagus, required retrosternal reconstruction using the colon. The segment of the colon that ascends to the cervical region is placed into either isoperistaltic or anisoperistaltic position depending on which will provide the best blood supply arcade.

Because with an experienced team we consider it extremely safe, whenever possible, the esophagectomy is performed laparoscopically. Our length-of-stay is about seven days. We do not routinely perform jejunostomies, except in complex cases or when faced with challenging anastomoses. We reinforce the entire suture line, except for the tubal anastomosis, which has three rows of staples. We do not perform pyloroplasties.

For tumors deemed unresectable, such as those that have tracheoesophageal or esophagobronchial fistulas, or in the setting of complete stenosis, we opt for gastric bypass by constructing a retrosternal isoperistaltic gastric tube, the so-called Postlethwait surgery (4), as modified by Lacerda and colleagues, with their own completely laparoscopic technique. (5, 6)

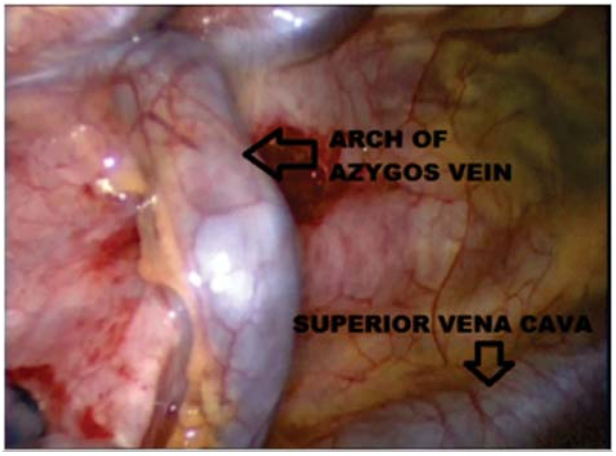

Figure 9 – *Anatomical detail, as seen through the thoracoscope, of the arch of the azygos vein. It should be ligated to have better access to the esophagus.*

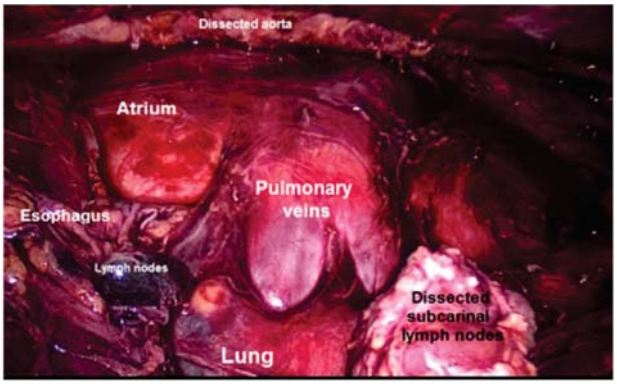

Figure 10 – *Thoracoscopic esophagectomy with mediastinal lymphadenectomy; the atrium, pulmonary vessels, and completely dissected esophagus are identified.*

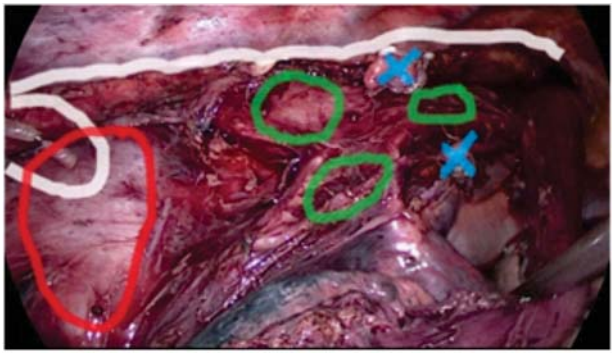

Figure 11 – *Thoracoscopy for esophagectomy, with structures exposed, with points of risk of injury identified. White: thoracic duct, red: atrium, green: bronchus and trachea, blue: azygos vein.*

RESUMO

O presente artigo tem por objetivo demonstrar a experiência do hospital de câncer de Barretos no tratamento cirúrgico do câncer de esôfago por videocirurgia. São descritas em detalhes a abordagem transmediastinal e a abordagem transtorácica, esta última utilizando a posição prona como relatado por Cadière. A presente série relata 83 casos operados de 2009 a 2012, dando ênfase à técnica videolaparoscópica com breve revisão da literatura, as indicações para cada técnica, bem como a sequência de passos que devem ser seguidos quando se usa esta modalidade de tratamento.

Palavras-chave: Videocirurgia. Esofagectomia. Toracoscopia. Esofagectomia trans-hiatal.

REFERENCES

1. Luketich JD, Alvelo-Rivera M, Buenaventura PO, Christie NA, McCaughan JS, Litle VR, et al. Minimally invasive esophagectomy: outcomes in 222 patients. Ann Surg. 2003 Oct; 238(4):486-94; discussion 94-5.
2. Nguyen NT, Hinojosa MW, Smith BR, Chang KJ, Gray J, Hoyt D. Minimally invasive esophagectomy: lessons learned from 104 operations. Ann Surg. 2008 Dec; 248(6):1081-91.
3. Cadière GB, Himpens J, Dapri G Esophagectomy by thoracoscopy in prone position followed by laparoscopy and cervicotomy J Chir (Paris). 2006 Jul-Aug;143(4):237-42.
4. Postlethwait RW. Technique for isoperistaltic gastric tube for esophageal bypass. Ann Surg. 1979 Jun; 189(6):673-6.
5. Lacerda CF, Vasques VL, Fava G, Wohnrath DR, Filgueiras GB, Torres AT. Isoperistaltic gastric bypass for palliative treatment of esophageal cancer - Postlethwait technique: Proposal of approach by laparoscopy. Braz J Video-Sur. 2010; 3(4):191-5.
6. Siosaki MD, Lacerda CF, Bertulucci PA, Costa Filho JO, Oliveira ATT. Bypass laparoscopic procedure for palliation of esophageal cancer. JSCR. 2013; 3 (3).

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