



# Thoracolaparoscopic McKeown esophagectomy

Changchun Wang<sup>1,2</sup>, Chao Pan<sup>2</sup>, Weimin Mao<sup>2</sup>, Qixun Chen<sup>2</sup>, Jinshi Liu<sup>2</sup>, Jian Hu<sup>1</sup>

<sup>1</sup>Department of Thoracic Surgery, the First Affiliated Hospital of Zhejiang University School of Medicine, Hangzhou 310003, China; <sup>2</sup>Department of Thoracic Surgery, Cancer Hospital of University of Chinese Academy of Sciences, Zhejiang Cancer Hospital, Hangzhou 310022, China

Correspondence to: Jian Hu. Department of Thoracic Surgery, the First Affiliated Hospital of Zhejiang University School of Medicine, Hangzhou 310003, China. Email: dr\_hujian@zju.edu.cn.

Submitted May 29, 2018. Accepted for publication Dec 20, 2018.

doi: 10.21037/jtd.2019.06.25

View this article at: <http://dx.doi.org/10.21037/jtd.2019.06.25>

## Introduction

Unlike Europe and America, the rate of esophageal squamous cell carcinoma (ESCC) in China is 90% higher (1); also, most of the lesions are located at the middle thoracic part of the esophagus. There has been an increasing number of esophagectomies has been performing by video-assisted thoracic surgery (VATS) in China. Patients are staged with an upper endoscopy and computed tomography (CT) chest/abdomen scan with oral and intravenous contrast. The positive emission tomography (PET) scan is not routine for the patients with esophageal cancer because of its high cost. An esophageal endoscopic ultrasound (EUS) is also performed to identify the depth of invasion. An ultrasound scanning on supraclavicular lymph nodes is performed for every patient. If T3 or lymphatic metastasis is detected, a new adjuvant therapy is recommended for the patients (2). However, a radical chemoradiation should be taken for the patients if the supraclavicular lymph nodes metastasis is identified by the needle. An endoscopic mucosal resection (EMR) is only performed for patients who are found to have T1aN0 lesions. An esophagectomy is reserved for patients with positive margins on the EMR. Our institutional consensus is to offer upfront esophagectomy without neoadjuvant therapy for patients with clinical T1–2N0M0 lesions, based on ultrasound, EUS, and CT scans.

Herein, we described a thoracolaparoscopic McKeown esophagectomy procedure (*Figure 1*). The patient was a 55 years old man, who was admitted to the hospital because of progressive dysphagia for more than one month. The endoscopy showed that there was a 1.0 cm eminence lesion in the esophagus 24 cm from the incisor, circumferential rough mucosa erosion 29 cm from the incisor, and tumor tissue growth 32–36 cm from the incisor. The pathologic

diagnosis through an endoscopic biopsy was revealed to be squamous cell carcinoma. We didn't find any indications for a new adjuvant therapy, but there was a positive lymph node around the gastric on the postoperative diagnosis report. Adjuvant chemotherapy was performed postoperatively.

## Surgical technique

At Zhejiang Cancer Hospital, we perform a McKeown esophagectomy when the lesion is located at the middle or upper part of the thoracic esophagus. Ivor Lewis esophagectomy is performed when the lesion was located at the lower esophagus. McKeown esophagectomy with a minimally-invasive approach, as illustrated in our video, has an anastomotic leak rate of less than 8%. It is much easier to treat anastomotic leak on the neck than in the thoracic cavity.

During the thoracic phase of the procedure, we usually place the patient in the lateral decubitus position with an anterior tilt. An incision of 15 mm in the 3rd intercostal space and an incision of 10 mm in the 7th intercostal space on the midaxillary line is made as the main operating port and camera port respectively. The incisions of 5 mm in the 5th and 9th intercostal space on the posterior axillary line were made as the auxiliary operating port and sucker port respectively. With single lumen intubation and CO<sub>2</sub> insufflation to a pressure of 8 mmHg, the whole right lung was deflated to visualize the esophagus better. The dissection procedure could be divided into five phases including the blocking of the posterior esophagus above the azygos vein, the blocking of the anterior esophagus above the azygos vein [including right recurrent laryngeal nerve (right RLN)], the blocking of posterior esophagus beneath azygos vein, the blocking of the anterior esophagus beneath



**Figure 1** Thoracoscopic McKeown esophagectomy (3).

Available online: <http://www.asvide.com/article/view/32485>

azygos vein, and the blocking of the subcarinal and left RLN. The azygos vein is usually cut to visualize the left RLN better. The thoracic duct is usually reserved unless the tumor invaded it. To obtain the best circumferential margin, the dissection was carried out along the surrounding landmark structures. In the block of the posterior esophagus above the azygos vein, the thoracic duct was exposed. The dissection should be suspended when the fat surrounding left RLN is exposed in case of injury. In the blocking of the anterior esophagus above the azygos vein, vagus nerve, trachea, and right RLN should be exposed. To protect the right RLN, it is vital that the right RLN is exposed firstly by blunt dissection. The dissection should be stopped again when the fat surrounding the left RLN is exposed. In the blocks beneath the azygos vein, aorta, pericardium, left inferior pulmonary vein, left pleura, and airway are skeletonized. The lung branches of the double vagus nerves are reserved. The hiatus of the diaphragm is not excessively exposed in case of CO<sub>2</sub> insufflating into the thoracic when the abdomen phase is then performed. In the last block, the esophagus was pulled ventrally with a suture line and the lymph nodes in the subcarinal, and the lymph nodes surrounding the left RLN were dissected. Blunt dissection followed by an energy dissection which is also essential for the left RLN. It was the single lumen intubation that allows for the trachea to be easily pulled to expose the lymph nodes surrounding the left RLN. A drainage tube with a diameter of 5 mm was placed in the esophagus bed after dissection.

For the abdominal and neck phase of the McKeown esophagectomy, the patient was placed in the supine position with a small pad under their shoulders. The procedure of abdominal phase was also divided into four blocks, the dissection of lesser curvature, the dissection

of left gastric vessels, common hepatic artery and short gastric vessels, the dissection of greater curvature, and the dissection of hiatus of the diaphragm. We performed these four blocks subsequently. The dissection was also carried out along the surrounding landmark structures. The related structures were skeletonized. The hiatus of the diaphragm should be appropriately reserved when lesser curvature is dissected to maintain the CO<sub>2</sub> pressure in the abdomen. The right gastroepiploic artery is pedicled. Then, we dissected the esophagus on the neck with or without lymph nodes dissection in this field. The esophageal mucosa was reserved longer than esophageal muscle by at least 5 mm on the proximal end when the esophagus was cut. The distal esophagus was sutured with a 40 cm long rubber tube. A 5 cm incision was performed beneath the xiphoid so the gastric conduit could be pulled out of the abdomen. A 3 cm wide gastric conduit was created, and the tip was sutured with the rubber tube. The gastric conduit was pulled through the rubber tube at the proximal end on the neck. The esophagogastric anastomosis was completed by a circular stapler then. The tubular gastric remnant was removed by linear stapler at 2 cm from the anastomotic stoma. The jejunostomy feeding tube was placed in the intestine 20 cm from the flexor ligament. The intestine was sutured with the peritoneum beside the stoma in case of intestinal obstruction.

We started enteral nutrition on postoperative day (POD) one through a jejunostomy tube. We performed a barium swallow on all patients on POD eight unless there was a clinical suspicion of leakage during the post-operative course. If there weren't any signs of leakage and functional gastric conduit evacuating disturbance, the patients would be discharged the next day with a thick semi-liquid diet as oral intake and obtaining their caloric requirements through tube feeds for one month or so.

## Comments

As the largest center for esophageal cancer in Zhejiang Province, China, the volume of esophagectomy in Zhejiang Cancer Hospital is more than 400 cases per year. Among these, more than 60% of these cases are performed through thoracoscopic including Ivor Lewis and McKeown. The remaining 40% of cases with esophagectomy are performed by VATS plus an open abdominal surgery or open surgery. The esophagectomy through left thoracic has hardly been performed in our hospital in the recent decade. As for surgery algorithm, our center has reached a

consensus on some key points.

Besides arrhythmia and pneumonia, RLN injury and anastomotic leak are the most important complications of a McKeown esophagectomy. RLN injury seems more severe than an anastomotic leak. Aspiration pneumonia is often followed with an RLN injury, which causes a series of syndromes such as respiratory dyspnea, hypoxemia, and even respiratory failure. So, it is essential to protect RLN from burning when dissecting the lymph nodes surrounding the left and right RLN. Considering 20–35% of the positive rate of lymph nodes surrounding RLN for ESCC in China (4,5), we must dissect the lymph nodes in these fields. We often expose RLN bluntly before dissection. We dissect pleura along with the right vagus until the right subclavian artery is exposed. At the intersection of the right subclavian artery and vagus nerve, we bluntly dissect the right RLN until it can be exposed fully. As for the lymph nodes surrounding the left RLN, it is most difficult to expose. We performed this field lastly. Single lumen intubation, which makes the trachea can be pulled easily, should be used for thoracoscopic esophagectomy. When esophagus and trachea are pulled away, we can dissect the lymph nodes surrounding left RLN easily. Whether or not block balloon is used in the single lumen intubation, the lung can be deflated very well with the pressure of CO<sub>2</sub> and do not impact the operation. With a positive rate of 9% (6), the subcarinal lymph node should be dissected routinely.

Another key point is the anastomosis. The anastomotic leak rate has decreased from 15% to less than 8% since we reserved more mucosa at the proximal end of the esophagus on the neck. Here, esophageal mucosa is at least 5 mm longer than the esophageal muscle. We have not found the difference of anastomotic leak rate between anastomosis by circular stapler and manual anastomosis, which is similar to Yan (7). Because anastomotic leak is easier to cure on the neck than in the thoracic, most of our colleagues would rather perform minimally invasive McKeown esophagectomy than perform minimally invasive Ivor Lewis esophagectomy.

## Acknowledgments

*Funding:* This study was supported by the National Key

Research and Development Program of China (Project 2017YFC0113500) and the Medical and Health of Zhejiang Province Scientific Research Project (2014KYA101, 2013KYA031).

## Footnote

*Conflicts of Interest:* This video was granted the Award of Great Potential in the 2017 AME-Medtronic Minimally Invasive Esophageal Surgery Video Contest.

*Informed Consent:* Written informed consent was obtained from the patients for publication of this manuscript and any accompanying images.

## References

1. Xu Y, Yu X, Chen Q, et al. Neoadjuvant versus adjuvant treatment: which one is better for resectable esophageal squamous cell carcinoma? *World J Surg Oncol* 2012;10:173.
2. van Hagen P, Hulshof MC, van Lanschot JJ, et al. Preoperative chemoradiotherapy for esophageal or junctional cancer. *N Engl J Med* 2012;366:2074-84
3. Wang C, Pan C, Mao W, et al. Thoracoscopic McKeown esophagectomy. *Asvide* 2019;6:187. Available online: <http://www.asvide.com/article/view/32485>
4. Tan Z, Ma G, Zhao J, et al. Impact of thoracic recurrent laryngeal node dissection: 508 patients with tri-incisional esophagectomy. *J Gastrointest Surg* 2014;18:187-93
5. Li H, Li Y, Liu X, et al. Patterns of lymphatic spread in thoracic esophageal squamous cell carcinoma: a study of 313 cases. *Zhonghua Zhong Liu Za Zhi* 2015;37:841-4.
6. Ma H, Li Y, Ding Z, et al. The clinical significance of subcarinal lymph node dissection in the radical resection of oesophageal cancer. *Interact Cardiovasc Thorac Surg* 2013;16:839-43.
7. Yan M, Chen YH, Liu XB, et al. Modified application of circular stapler to cervical esophagogastric anastomosis after esophagectomy for esophageal cancer. *Ai Zheng* 2009;28:768-70.

**Cite this article as:** Wang C, Pan C, Mao W, Chen Q, Liu J, Hu J. Thoracoscopic McKeown esophagectomy. *J Thorac Dis* 2019;11(6):2564-2566. doi: 10.21037/jtd.2019.06.25