

## Thoracoscopic Esophagectomy in Supine Position

Abbas Abdollahi<sup>1</sup>; Mohammad Alipour<sup>2</sup>; Alireza Tavassoli<sup>3</sup>; Ali Jangjoo<sup>1,\*</sup>

<sup>1</sup>Surgical Oncology Research Center, Mashhad University of Medical Sciences, Mashhad, IR Iran

<sup>2</sup>Department of Anesthesiology, Faculty of Medicine, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, IR Iran

<sup>3</sup>Endoscopic and Minimally Invasive Surgery Research Center, Mashhad University of Medical Sciences, Mashhad, IR Iran

\*Corresponding author: Ali Jangjoo, Surgical Oncology Research Center, Mashhad University of Medical Sciences, Mashhad, IR Iran. Tel: +98-5138022677; +98-9155111493, Fax: +98-5138525255, E-mail: jangjooa@mums.ac.ir

Received: February 24, 2015; Accepted: March 2, 2015

**Background:** Esophageal cancer needs major surgery due to its anatomic position, which is followed by high morbidity in most patients. Thoracotomy, a previously used method, was accompanied by high pulmonary complications, had physical limitations, and low tolerance of patients. Thoracoscopic esophagectomy is a new suitable method with less morbidity.

**Objectives:** The present study aimed to investigate the results of performing three phases of esophagectomy through laparoscopy and thoracoscopy in supine position without frequent changes in patients' position.

**Patients and Methods:** This is a prospective study of 15 selected patients who underwent laparoscopic thoracoscopic esophagectomy and received preoperative radiotherapy between 2010 and 2011. At first, laparoscopic gastrolysis was carried out and then, transhiatal esophageal release was performed (up to the upper region); thereafter the upper esophagus was exposed by thoracoscopy in supine position and easily released.

**Results:** The mean duration of esophagectomy was 70 minutes and the total operation 180 minutes. The mean amount of bleeding during surgery was 250 cc. Conversion to open approach occurred only in one patient out of 15. No cases of anastomotic leakage or pneumonia was observed. Also, no case of mortality was reported.

**Conclusions:** Thoracoscopic esophagectomy can be easily performed in supine position and in a short time.

**Keywords:** Supine Position; Thoracoscopy; Esophagectomy

### 1. Background

Esophagectomy is usually considered an extended operation comprising three stages; the thoracic phase for esophageal release, the abdominal phase for gastrolysis, and the cervical phase for esophagogastrostomy anastomosis. Three traditional procedures for treatment of esophageal cancer include Ivor Lewis, Transhiatal, and McKeown (1).

With the introduction of modern endovision techniques, an increasing tendency occurred towards minimally invasive surgery. In thoracic phase, the esophageal release is performed either in prone or lateral decubitus positions with its particular advantages and disadvantages. These methods require changes in patient's position into supine for accomplishing the abdominal and cervical phases of the surgery (2-6).

### 2. Objectives

The present study aimed to investigate the results of performing three phases of esophagectomy through laparoscopy and thoracoscopy in supine position without changing the patients' position.

### 3. Patients and Methods

This is a prospective study of 15 selected patients who

underwent laparoscopic thoracoscopic esophagectomy and received pre-operative radiotherapy between 2010 and 2011. The patients with middle or lower esophageal cancer enrolled in the study after cardiac and pulmonary consultation. All patients received preoperative radiotherapy and the disease was not beyond the T3 N2 stage. The surgery was performed as following for all patients. The patient was placed in supine position. The abdomen was explored via five 5 - 12 mm ports. Laparoscopic gastrolysis was performed and the esophagus was dissected through hiatus as high as possible. The cardia was separated from the stomach with two blue endo GIA (Covidien Company, USA). The stomach was sutured to the esophagus for pulling it up to the neck. Then, the incision was done in the left side of the neck and cervical esophagus was released and a tape was encircled around the esophagus and steered into the right hemithorax through opening of right mediastinal pleura via cervical incision. The patient underwent one-lung ventilation.

Then, the thoracoscopy trocars were inserted just below the right nipple (in the anterior axillary line). The ports were inserted in the third and seventh intercostal spaces. After entry into the thorax cavity, the pleura of the esophagus was firstly opened and the tape around the

esophagus was exposed. While guiding the tape, cervical and mediastinal esophagus were released and if needed, azygos vein was ligated. Sometimes, a retractor was used to control the right lung. With pulling the tape around or up and down, the esophagus was easily released and if needed, the mediastinal lymph nodes were removed. The esophagus was pulled up to the neck incision and the sutured stomach also steered into the neck. The cervical esophagus was resected and esophago-gastric anastomosis was performed in the neck with 25 mm circular staplers. Right thoracostomy tube was used for all patients and kept in to decrease the discharge to less than 100 cc/d. Patients were transferred to the intensive care unit (ICU) for one night and then followed in the ward. Seven days after the operation, they underwent upper gastrointestinal barium swallow. In case of intact anastomosis, oral fluid was started and the patient was discharged after tolerating oral diet.

#### 4. Results

Fifteen patients with esophageal cancer underwent esophagectomy in supine position. Eight patients were female (53.3%) and seven (46.7%) male with the mean age of  $45.13 \pm 8.86$  years. Mean operative time, including gastrotomy and esophagectomy, was  $180.0 \pm 15.8$  minutes and esophagectomy alone  $70.1 \pm 7.9$  minutes. The intra-operative oxygenation was suitable and arterial blood saturation was never less than 90%.

In one patient (6.67%) we had to convert the surgery to open approach due to azygos vein involvement (the evaluation of the lymph nodes of this region showed adhesion and invasion to azygos vein) and severe bleeding during dissection. The mean intra-operative bleeding volume was  $248.3 \pm 29.2$  cc and blood transfusion was required in only one patient (6.67%) due to severe bleeding. The mean hospitalization duration in ICU was two days and only one patient was hospitalized in ICU for 10 days, which was due to postoperative complication of respiratory failure (6.67%). The mean duration of hospitalization was eight days. No case of mortality was reported.

#### 5. Discussion

Minimally invasive surgery is increasingly used in the treatment of esophageal cancer. In this method gastrotomy and esophagotomy are performed through some ports and a limited number of incisions, then the stomach is separated from the esophagus by some staplers and finally, the stomach is transposed to the neck for esophago-gastric anastomosis while the esophagus is departed from the neck (3).

All previous studies revealed that it is necessary to change patient's position during surgery in this type of operation. The patients are positioned in the lateral decubitus position then turned to supine position for abdominal and cervical procedures (3). In prone position, the patient undergoes esophagotomy and then the abdominal

(gastrotomy) and cervical stages are carried out while the patient is in the supine position (7, 8). The main controversy is on the position of the patients during esophageal release.

In minimally invasive surgery, several methods have been proposed to release the esophagus. Watanabe et al. recommended three-stage open esophagectomy in prone position because of improved arterial oxygenation (8). Kuwabara and colleagues were also in favor of prone position, because of its superiority in less blood loss, respiratory tract complications, postoperative hospital stay, and number of lymph nodes dissected (7). Another study by Noshiro et al. reported prone esophagectomy with significantly less blood loss, but longer operation time (9). Findings of a retrospective analysis of small numbers of patients suggested that hemodynamic parameters remain stable during prone positioning (10). Fabian et al. indicated the results of prone positioning to be equivalent to lateral decubitus in terms of blood loss, lymph node dissection, and complications and reported significantly shorter operative duration in prone position. The authors concluded that conversion to open thoracotomy may be easier in lateral position (11). But, the previous studies did not give any preference to any of the two methods (3). In case of need for conversion to open surgery, lateral positioning is more suitable than the prone position. In addition to longer operative time, changes in patient's positioning may be associated with risk of displacement of critical/vital lines including the endotracheal tube and vascular cannula.

Thus, we decided to perform all three stages of the operation in supine position with no changes in patient's positioning. In this method, esophagus is accessible through the abdomen, thorax, and neck.

This procedure was successfully conducted in all patients with no need to change patients' position. Directing the tape into mediastinum facilitates the diagnosis and dissection of the esophagus and also shortens the operation time. In these patients, the obvious lymph nodes can be dissected. The main problem is the transposition of the lung to the anterior hemithorax. This can be managed by using an additional 5-mm-port. Our patients showed no significant blood loss. Physiologic parameters remained stable during surgery. No clear changes were observed with respect to saturated percentage of oxygen in blood ( $SpO_2$ ), arterial blood pressure, and airway pressure.

In our patients, esophagectomy was performed in less than 70 minutes and the whole operation took less than 180 minutes. No pulmonary complications were observed. Another advantage of the supine position is its ergonomically comfortability, as anatomic position of the lungs and mediastinum remains in normal condition. It can also be easily taught to low-experienced surgeons.

Local tumor control can be performed better in the thoracoscopic approach. It reduces the possibility of recurrence, because the surgeon's view for dissection of

esophagus and involved lymph nodes and obtaining safe margins is superior to blunt dissection (12).

Thoracoscopic esophagectomy in supine position may be considered as a reliable method, which provides better ergonomics and exposure; in this position the operative time is shortened, bleeding amount is less, endotracheal and intravenous line cannula displacement is prevented, the anatomic landmark is easily diagnosed and their injuries are prevented, and finally the lymph nodes are dissected while the physiologic parameters such as arterial blood gas saturation, airway pressure, and blood pressure remain stable.

## Acknowledgements

The authors gratefully acknowledge the contribution of Ms. M. Hassanpour for editing the manuscript.

## Authors' Contributions

Study concept and design: Abbas Abdollahi and Ali Jangjoo. Acquisition of data and statistical analysis: Abbas Abdollahi, Mohammad Alipour, Alireza Tavassoli, and Ali Jangjoo. Analysis and interpretation of data: Abbas Abdollahi and Ali Jangjoo. Drafting of the manuscript: Abbas Abdollahi, Alireza Tavassoli, and Ali Jangjoo. Critical revision of the manuscript for important intellectual content: Abbas Abdollahi and Ali Jangjoo. Administrative, technical, and material support: None. Study supervision: Abbas Abdollahi.

## References

1. Jobe B, Hunter J, Peters J. Esophagus and diaphragmatic hernia. In: Brunnicardi F, Andersen D, Billiar T, Dunn D, Hunter J, Mat-

thews J editors. *Schwartz's Principles of Surgery*. 9 ed. New York, NY: McGraw-Hill; 2010. pp. 810-1.

2. Pennathur A, Luketich JD. Minimally invasive surgical treatment of esophageal carcinoma. *Gastrointest Cancer Res*. 2008;**2**(6):295.
3. Jarral OA, Purkayastha S, Athanasiou T, Zacharakis E. Should thoracoscopic three-stage esophagectomy be performed in the prone or left lateral decubitus position? *Interact Cardiovasc Thorac Surg*. 2011;**13**(1):60-5.
4. Nagpal K, Ahmed K, Vats A, Yakoub D, James D, Ashrafian H, et al. Is minimally invasive surgery beneficial in the management of esophageal cancer? A meta-analysis. *Surg Endosc*. 2010;**24**(7):1621-9.
5. Yatabe T, Kitagawa H, Yamashita K, Akimori T, Hanazaki K, Yokoyama M. Better postoperative oxygenation in thoracoscopic esophagectomy in prone positioning. *J Anesth*. 2010;**24**(5):803-6.
6. Feng MX, Tan LJ, Wang H, Liang MQ, Zhang Y, Shen YX, et al. [Comparison of thoracoscopic esophagectomy in decubitus position with prone position]. *Zhonghua Wei Chang Wai Ke Za Zhi*. 2011;**14**(9):686-8.
7. Kuwabara S, Katayanagi N. Comparison of three different operative methods of video-assisted thoracoscopic esophagectomy. *Esophagus*. 2010;**7**(1):23-9.
8. Watanabe I, Fujihara H, Sato K, Honda T, Ohashi S, Endoh H, et al. Beneficial effect of a prone position for patients with hypoxemia after transthoracic esophagectomy. *Crit Care Med*. 2002;**30**(8):1799-802.
9. Noshiro H, Iwasaki H, Kobayashi K, Uchiyama A, Miyasaka Y, Masatsugu T, et al. Lymphadenectomy along the left recurrent laryngeal nerve by a minimally invasive esophagectomy in the prone position for thoracic esophageal cancer. *Surg Endosc*. 2010;**24**(12):2965-73.
10. Kim DJ, Hyung WJ, Lee CY, Lee JG, Haam SJ, Park IK, et al. Thoracoscopic esophagectomy for esophageal cancer: feasibility and safety of robotic assistance in the prone position. *J Thorac Cardiovasc Surg*. 2010;**139**(1):53-59 e1.
11. Fabian T, Martin J, Katigbak M, McKelvey AA, Federico JA. Thoracoscopic esophageal mobilization during minimally invasive esophagectomy: a head-to-head comparison of prone versus decubitus positions. *Surg Endosc*. 2008;**22**(11):2485-91.
12. Thomson IG, Smithers BM, Gotley DC, Martin I, Thomas JM, O'Rourke P, et al. Thoracoscopic-assisted esophagectomy for esophageal cancer: analysis of patterns and prognostic factors for recurrence. *Ann Surg*. 2010;**252**(2):281-91.