Effect of Esophagus Position on Surgical Difficulty and Postoperative Morbidities After Thoracoscopic Esophagectomy

Naoya Yoshida, MD, PhD,[*] Yoshifumi Baba, MD, PhD,[*] Hironobu Shigaki, MD, PhD,[*] Shinya Shiraishi, MD, PhD,[†] Kazuto Harada, MD, PhD,[*] Masayuki Watanabe, MD, PhD,[‡] Masaaki Iwatsuki, MD, PhD,[*] Junji Kurashige, MD, PhD,[*] Yasuo Sakamoto, MD, PhD,[*] Yuji Miyamoto, MD, PhD,[*] Takatsugu Ishimoto, MD, PhD,[*] Keisuke Kosumi, MD,[*] Ryuma Tokunaga, MD,[*] Yasuyuki Yamashita, MD, PhD,[†] and Hideo Baba, MD, PhD[*]

The objective include thoracoscopic esophagectomy for the deep-seated (left-sided) esophagus has several technical difficulties, which may affects the intraoperative or postoperative outcomes. However, no previous studies have focused on the correlation between the position of the esophagus and short-term outcome after thoracoscopic esophagectomy. Of 470 esophagectomies between April 2005 and April 2015 in Kumamoto University Hospital, 112 patients who underwent thoracoscopic esophagectomy for esophageal cancer were examined. The position of the esophagus was divided into 2 types: deep-seated esophagus or another type based on computed tomographic images in the supine position. In results, the deep-seated esophagus was associated with a longer operation time in the thorax and high incidence of severe morbidity of Clavien-Dindo classification ≥IIIb, pneumonia, and any pulmonary morbidity. The deep-seated esophagus was also an independent risk factor for severe morbidity (hazard ratio [HR] = 5.37, 95% CI: 1.307-22.03; $P = 0.020$), pneumonia (HR = 9.23, 95% CI: 2.150-39.60; $P = 0.003$), and any pulmonary morbidity (HR = 10.3, 95% CI: 2.714-38.78; $P < 0.001$). In conclusion, the position of the esophagus had a strong influence on the difficulty of thoracoscopic esophagectomy and the incidence of postoperative morbidities. Surgeons would be well advised to keep a careful watch perioperatively for patients with a deep-seated esophagus.

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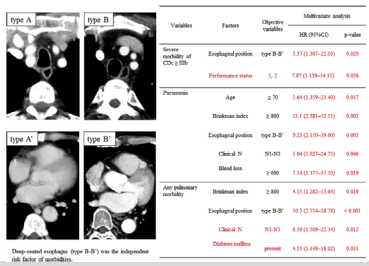
Keywords: Esophageal cancer, Esophageal position, Postoperative morbidity, Thoracoscopic esophagectomy



Central Picture: Deep-seated esophagus (type B-B) is an independent risk factor of morbidities.

Central Message

The deep-seated esophagus correlated with the difficulty of thoracoscopic esophagectomy and high incidence of morbidities.

Perspective

Thoracoscopic esophagectomy for the deep-seated (left-sided) esophagus has several technical difficulties. This study revealed that esophagectomy for the deep-seated esophagus required longer operation time and correlated with increase in several postoperative morbidities. Those results suggested that surgeons need to pay careful attention to patients with a deep-seated esophagus perioperatively.

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Esophagectomy for esophageal cancer is a highly invasive surgery that is associated with a high rate of postoperative morbidity.[1] However, thoracoscopic esophagectomy was recently introduced as a less invasive surgery[2,3] and has replaced open esophagectomy to a large extent.[4] According to the latest report by the Japanese Association for Thoracic Surgery, thoracoscopic and laparoscopic esophagectomy was adopted for 48.6% of patients with superficial esophageal cancer and for 27.8% of patients with advanced esophageal cancer in Japan in 2012. The number of cases undergoing thoracoscopic esophagectomy has increased 5 times in the recent decade.

Although thoracoscopic esophagectomy is certainly associated with decreased intraoperative bleeding, less wound pain, and early ambulation, it also requires longer operation time, which would lead to unavoidable stress for both patients and surgeons.[5–7] To date, it is unclear whether thoracoscopic esophagectomy can

[*]Department of Gastroenterological Surgery, Kumamoto University, Kumamoto, Japan
[†]Department of Diagnostic Radiology, Graduate School of Medical Sciences, Kumamoto University, Kumamoto, Japan
[‡]Department of Gastroenterological Surgery, Cancer Institute Hospital of Japanese Foundation for Cancer Research, Tokyo, Japan

Address reprint requests to Hideo Baba, MD, PhD, Department of Gastroenterological Surgery, Graduate School of Medical Sciences, Kumamoto University, 1-1-1 Honjo, Chuoku, Kumamoto 860-8556, Japan. E-mail: hdobaba@kumamoto-u.ac.jp

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reduce postoperative morbidities. Only one prospective trial has reported the advantages of thoracoscopic esophagectomy in the reduction of postoperative morbidities.[7]

On the other hand, many studies have been conducted to identify the risk factors of postoperative morbidities after esophagectomy.[8-15] Among the risk factors reported, the importance of the esophagus position, which represents the anatomical relationship between the esophagus and the trachea or the vertebrae, has never been discussed. Therefore, in the present study, we aimed to investigate the surgical difficulty and short-term outcomes of thoracoscopic esophagectomy according to the position of the esophagus.

MATERIALS AND METHODS

Patients

Between April 2005 and April 2015, 470 patients underwent elective subtotal esophagectomy for esophageal cancer in the Department of Gastroenterological Surgery, Kumamoto University. Among these patients, 125 received thoracoscopic esophagectomy since May 2011. Of these patients, 6 who underwent reconstruction using the colon conduit, 2 who underwent 2-stage esophagectomy and one who underwent esophagectomy with only 1-field lymphadenectomy were excluded from the present study. In addition, 1 patient who received preoperative chemoradiotherapy, 2 patients with an aberrant artery or an intensive arterial tortuosity, and 1 patient who did not undergo preoperative computed tomography (CT) examination were also excluded. Consequently, 112 patients were eligible for this study. Clinical and surgical data were collected from among the prospectively entered data in the clinical database. The pretreatment tumor stage was classified according to the Union for International Cancer Control TNM staging, version 7.[16] Our institutional ethics committee approved the present study (Registry No. 1007). Documented comprehensive consent was obtained from all of the patients.

Definition of the Position of the Esophagus

We presumed that the esophagus located in the left side of the mediastinum might pose technical difficulties in surgery. Therefore, as shown in Central picture and Figure, the esophageal position was divided into 2 categories, namely, the upper and middle to lower mediastinum. In the upper mediastinum, the esophageal position was classified at the trachea level between the brachiocephalic artery and the superior border of the bifurcation of the main bronchus. A type A esophagus was defined as an esophagus located below the baseline of the trachea and with at least one-half of the esophagus located just under the trachea. A type B esophagus was defined as an esophagus with at least one-half of the

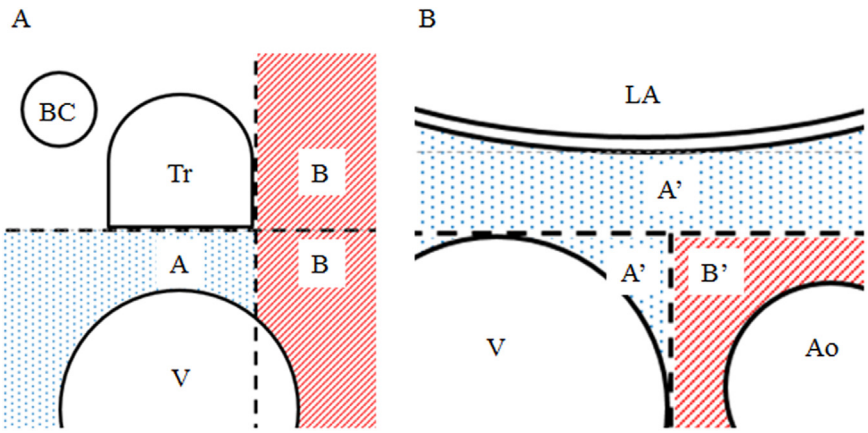

Figure. Scheme of the classification of esophageal position. (A) Classification in the upper mediastinum: Type A esophagus was defined as an esophagus located below the baseline of the trachea and with at least one-half of the esophagus located just under the trachea (*Dot meshing*). Type B esophagus was defined as at least one-half of the esophagus located on the left side of the trachea (*Slant*). (B) Classification in the middle to the lower mediastinum: Type A′ esophagus was defined as an esophagus located just above the vertebra or with at least one-half of the esophagus located above the horizontal line of the summit of the vertebra (*Dot meshing*). Type B′ esophagus was defined as an esophagus located on the left side of the vertebra and with at least one-half of the esophagus located below the summit of the vertebra (*Slant*). *BC*, brachiocephalic artery; *Tr*, trachea; *V*, vertebral body; *LA*, left atrium; *Ao*, aorta. (Color version of figure is available online at http://www.semthorcardiovascsurg.com.)