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A Mediastinoscopic Approach With Bilateral Cervicopneumomediastinum in Radical Thoracic Esophagectomy

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We previously reported the performance of "mediastinoscopic esophagectomy with lymph node dissection" (MELD) under pneumomediastinum using a transcervical and transhiatal approach, as a method of radical esophagectomy. The procedure included the dissection of the left tracheobronchial lymph nodes (106tbL). We described our technique for dissecting the upper mediastinal lymph nodes. We revealed that the 106tbL lymph nodes were almost completely retrieved but that the upper thoracic paraesophageal lymph nodes (105) and the right recurrent nerve lymph nodes (106recR) were not completely retrieved. We are therefore of the opinion that a right cervical pneumomediastinal approach is necessary to achieve total dissection. We herein describe a case that was surgically treated using a bilateral cervicopneumomediastinal approach. A 68-year-old male patient was referred to our institution to undergo treatment for lower thoracic esophageal squamous cell carcinoma. The right recurrent nerve was first identified using an open approach. Pneumomediastinum was then initiated to allow for the 105 and 106recR lymph nodes to be completely dissected along the right mediastinal pleura, the right vagus nerve, the proximal portion of the azygos vein, and the right bronchial artery. The left recurrent nerve lymph nodes (106recL) and 106tbL lymph nodes were dissected as described previously. In order to perform bilateral upper mediastinal

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lymph node dissection and esophagectomy, a bilateral cervicopneumomediastinal approach is needed.

Key words: Minimally invasive esophagectomy – Cervical approach – Esophageal cancers – Mediastinoscopic esophagectomy – Pneumomediastinum, MELD

Minimally invasive esophagectomy has been attempted using thoracoscopic surgery,[1,2] and radical mediastinal lymphadenectomy is usually performed using the transthoracic route. Thus, this method mandates the use of one-lung ventilation, some destruction of the thoracic wall, or prone positioning. We therefore considered whether it is possible to perform radical esophagectomy without the transthoracic approach, because the esophagus and regional lymph nodes are located in the mediastinum, between the bilateral mediastinal pleura. We previously developed and reported on "mediastinoscopic esophagectomy with lymph node dissection" (MELD) under pneumomediastinum using a combined transcervical and transhiatal crossover approach as radical esophagectomy.[3] The procedure included the dissection of the left tracheobronchial lymph nodes (106tbL). The report described how to perform complete upper mediastinal dissection, especially the dissection of the 106tbL lymph nodes. After we applied this method to clinical cases, thoracoscopic observation revealed that the 106tbL lymph nodes were almost completely retrieved but that the upper thoracic paraesophageal lymph nodes (105) and the right recurrent nerve lymph nodes (106recR) were not. This seemed to be because we dissected the 105 and 106 recR lymph nodes in open surgery. We are therefore of the opinion that the pneumomediastinal approach through a right cervical incision is necessary for achieving the complete dissection of these lymph nodes. We herein describe a case in which the complete dissection of the upper mediastinum was performed using a bilateral cervicopneumomediastinal approach.

Case Presentation

A 68-year-old male patient was referred to our institution to undergo treatment for esophageal squamous cell carcinoma. Esophagoscopy was indicated because the tumor was located in the lower thoracic esophagus–abdominal esophagus, shaped as a prominent tumor with a slightly depressed area and diagnosed as Type 1+0-IIc. The depth of tumor invasion was determined to be T2. Computed tomography (CT) examination located the lesion at the lower thoracic esophagus–abdominal esophagus and showed an enlargement of the right cardiac lymph nodes (No. 1). The cancer was clinically diagnosed as T2N1M0 cStage IIB according to the Union for International Cancer Control TNM classification (seventh edition). Stage IIB patients are usually given neoadjuvant treatment as the standard care in Japan. However, the patient declined neoadjuvant chemotherapy and hoped instead to undergo surgery. Therefore, to obtain sufficient informed consent, we suggested radical esophagectomy via the mediastinoscopic method as a clinical trial, and transthoracic approach as standard therapy. He ultimately selected to undergo the mediastinoscopic esophagectomy procedure (including dissection of the mediastinal lymph nodes) via the transcervical and transhiatal crossover approach. Laparoscopic surgery was used to dissect the upper abdominal lymph nodes and achieve gastric conduit mobilization. The middle to lower mediastinal lymph node dissection using the transhiatal approach was then performed according to the previously reported method.[4] The pericardium, inferior bilateral pulmonary vein, and inferior border of the carina tracheae were clearly exposed, and the subcarinal lymph nodes (107) and left main bronchus lymph nodes (109L) were dissected.

The transcervical approach was performed as follows: First, a right cervical collar incision (about 4 cm) was made 1 cm above the right clavicle, and sufficient working space was created between the tracheoesophageal groove and right carotid sheath. The right cervical paraesophageal lymph nodes (101R) and part of the right recurrent nerve lymph nodes (106recR) were dissected as they would be in open surgery (Fig. 1). Open surgery was then changed to the pneumomediastinal method. A single-port laparoscopic access device (EZ Access, Hakko Corporation, Nagano, Japan) was attached and three 5-mm trocars were placed in a triangle configuration (Fig. 2). Pneumomediastinum (to a pressure of 10 mmHg) was then established with CO_2. With the exception of the lymph nodes around

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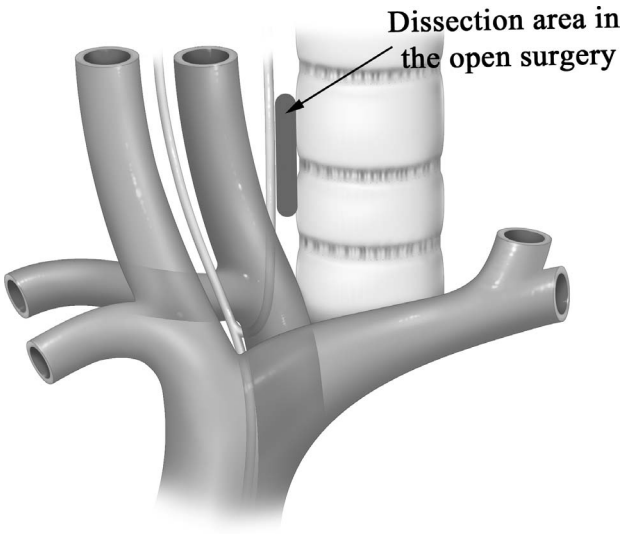

Fig. 1 The procedures performed in the open part via the right cervical approach. The region highlighted in gray is dissected during open surgery via a right cervical approach.

the recurrent nerve, dissection was chiefly performed using a LigaSure Maryland (Medtronic, Minneapolis, Minnesota). Using the pneumomediastinal method, it was possible to almost com-

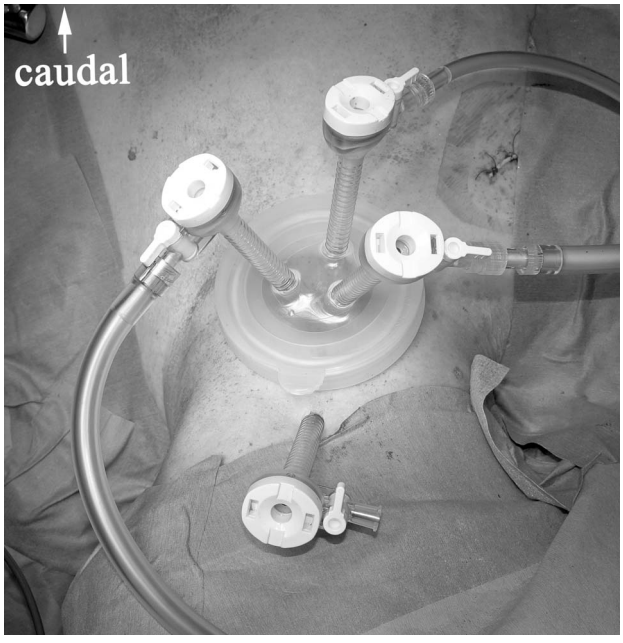

Fig. 2 The location of the single-port laparoscopic access device in the cervical approach. This figure shows the right cervical area. A single-port laparoscopic access device with three 5-mm trocars was placed in a triangle configuration. Above this device, a 5-mm trocar was inserted as a mediastinoscopic port.

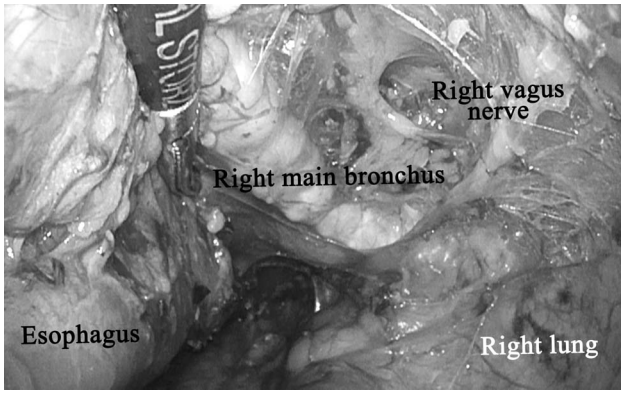

Fig. 3 The 105 and 106recR lymph node dissection via a right cervical approach with pneumomediastinum. The right vagus nerve is observed along the right mediastinal pleura. The right lung is observed through the right mediastinal pleura. The 105 and the 106recR lymph nodes were completely dissected.

pletely dissect the 105 and 106recR lymph nodes along the right mediastinal pleura, the right vagus nerve, the proximal portion of the azygos vein, and the right bronchial artery (Figs. 3 and 4). The thoracic duct was also clearly recognized via the right cervical approach. The esophagus was separated from the prevertebral layer, the thoracic duct, and the descending aorta (Figs. 5 and 6).

Next, a left cervical incision was made symmetrically, and a sufficient working space was created between the tracheoesophageal groove and left carotid sheath. Open surgery on the left side was subsequently changed to the pneumomediastinal method after the identification of the left recurrent

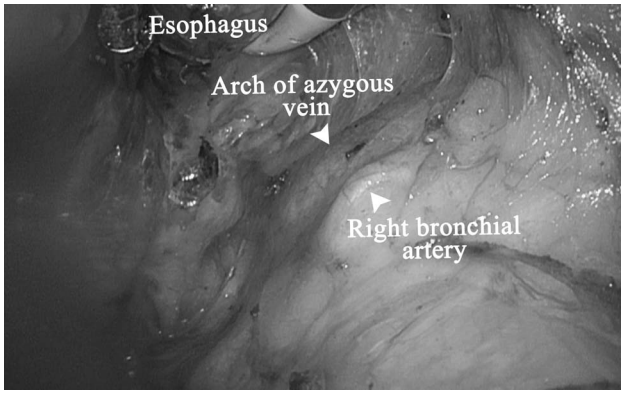

Fig. 4 The proximal portion of the azygos vein and the right bronchial artery via a right cervical approach with pneumomediastinum. The proximal portion of azygos vein and right bronchial artery is observed along the right mediastinal pleura.

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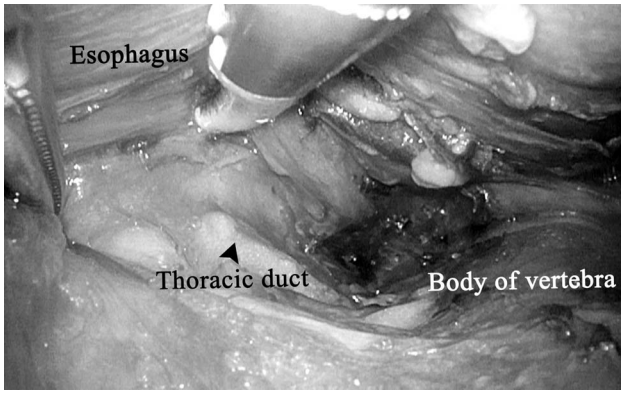

Fig. 5 The thoracic duct via a right cervical approach with pneumomediastinum. The esophagus was dissected from the prevertebral layer and thoracic duct via a right cervical approach with pneumomediastinum.

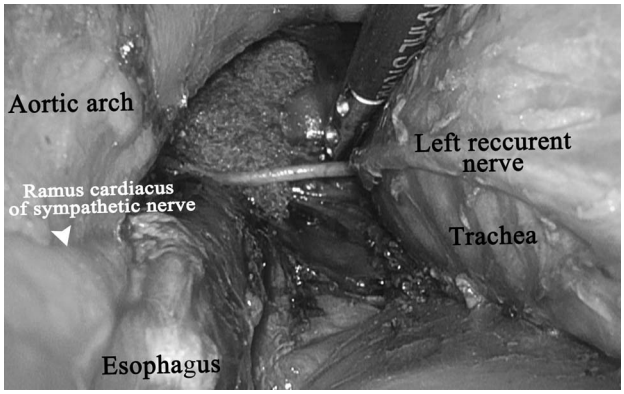

Fig. 7 The dissection of the 106recL lymph nodes via a left cervical approach with pneumomediastinum. The 106recL lymph nodes are dissected along the left main bronchus, the common carotid artery, the subclavian artery, the thoracic duct, the aortic arch, and the left recurrent nerve. The ramus cardiacus of sympathetic nerve can be detected along with the left subclavian artery.

nerve. A single-port laparoscopic access device was attached, and the left recurrent nerve lymph nodes (106recL) were dissected along the tracheal wall, the left common carotid artery, the subclavian artery, and the left recurrent nerve (Fig. 7). The ramus cardiacus of the sympathetic nerve and the thoracic duct were determined, and the esophageal wall was divided from the membranous trachea, the prevertebral layer, the left main bronchus, and the aortic arch, and was then cut at the level of the upper margin of the aortic arch. The distal portion of the esophagus was pulled towards the abdominal area.

For the dissection of the 106tbL lymph nodes, we used the previously reported "crossover technique." [3] In this technique, the trachea was retracted via the left cervical part, thus obtaining a good view between the lower margin of the aortic arch and the cartilage of the left main bronchus. Using this technique, the 106tbL lymph nodes were able to be observed and dissected via the right cervical approach (Fig. 8).

After these mediastinoscopic procedures, we observed whether or not the dissection of the mediastinal lymph nodes had been satisfactorily performed, using a thoracoscope. If the lymph

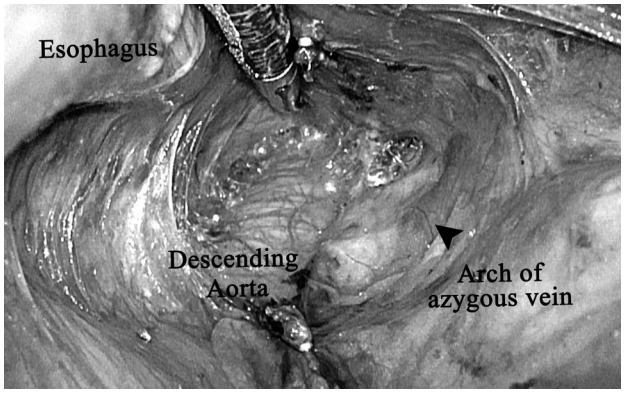

Fig. 6 The descending aorta via a right cervical approach with pneumomediastinum. The esophagus was dissected from the descending aorta.

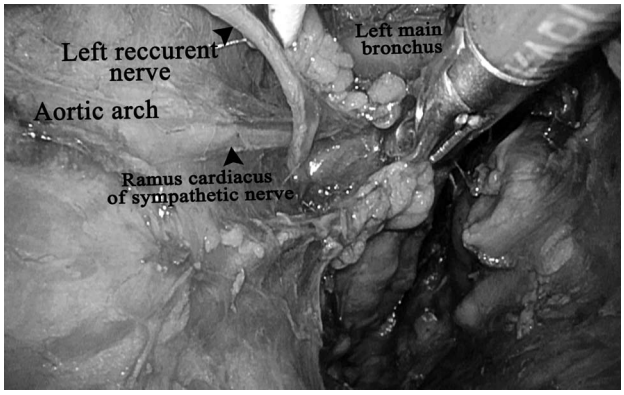

Fig. 8 The dissection of the 106tbL lymph nodes via a right cervical approach with pneumomediastinum. We used the "crossover technique." The trachea was retracted via a left cervical approach to obtain a good view between the aortic arch and the cartilage of the left bronchus. The 106tbL lymph nodes were able to be dissected via the right cervical approach with pneumomediastinum.

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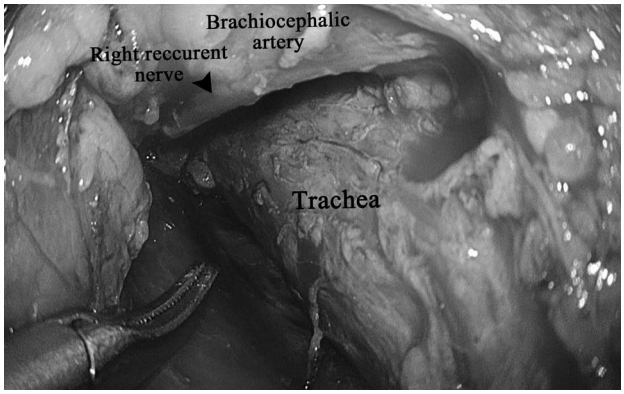

Fig. 9 The observation of the results of the mediastinoscopic dissection of the 105 and 106recR lymph nodes using a thoracoscope. After performing mediastinoscopic dissection, we used a thoracoscope to determine whether the dissection of the mediastinal lymph nodes was complete or not. The 105 and 106recR lymph nodes were found to have been almost completely dissected.

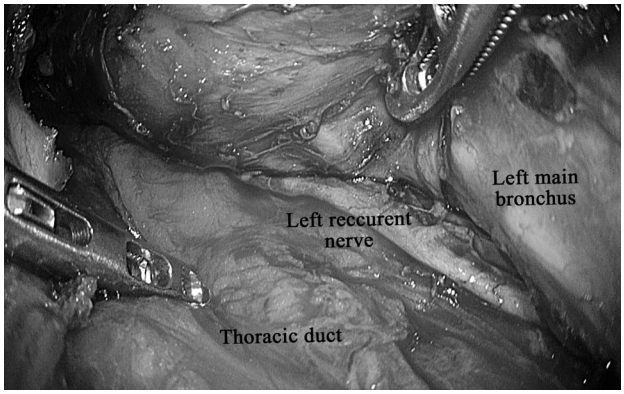

Fig. 10 The thoracoscopic observation of the results of the mediastinoscopic dissection of the 106recL lymph nodes. The 106recL lymph nodes were almost completely dissected.

nodes were not completely dissected, we intended to retrieve the remnant lymph nodes. However, the 105 and 106recR lymph nodes were almost completely dissected (Fig. 9), as were the 106recL lymph nodes (Fig. 10) and the 107 and 109L lymph nodes (Fig. 11). The gastric conduit was pulled through the poststernum route into the left cervical area, where esophagogastric anastomosis was performed. This patient had an uneventful recovery after the operation and was discharged on postoperative day 10.

Discussion

Previous reports have described the use of mediastinal esophagectomy.[5–10] This technique is recognized as minimally invasive surgery. However, in these reports the upper mediastinal lymph nodes, including the 106tbL lymph nodes, were not usually dissected.

We recently reported on the usefulness of the cervicohiatal crossover approach using Thiel-embalmed cadavers.[3] The dissection of the 106tbL lymph nodes can easily be performed using our method. However, thoracoscopic observation revealed that the 105 and 106rec lymph nodes were not completely retrieved in clinical cases. This seemed to be because we used open surgery to dissect the 105 and 106recR lymph nodes. We are of the opinion that a right cervicopneumomediastinal approach is necessary for achieving the complete dissection of these lymph nodes.

We herein demonstrate that the 105 and 106recR lymph nodes can be dissected using a pneumomediastinal approach through a right cervical incision. This method enabled us to perform a more complete upper mediastinal dissection and might be considered to be a method of radical esophagectomy. We believe that our initial experience with the pneumomediastinal approach through a right cervical incision is a breakthrough that will lead to the development of a truly complete mediastinal dissection method for thoracic esophageal cancer.

We conclude that a bilateral cervico-pneumomediastinal approach is necessary to perform bilateral upper mediastinal lymph node dissection and esophagectomy.

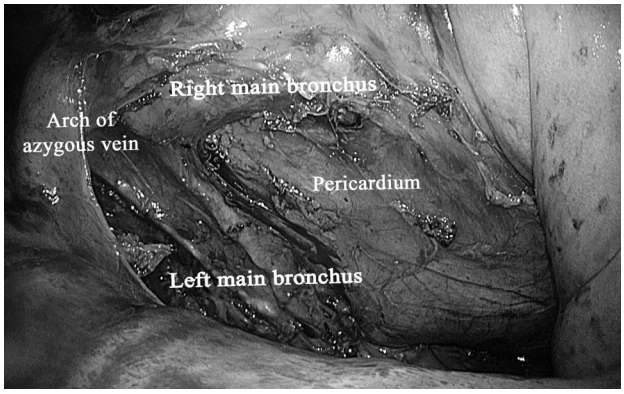

Fig. 11 The thoracoscopic observation of the results of the mediastinoscopic dissection of the 107 and 109L lymph nodes. The 107 and 109L lymph nodes were almost completely dissected.

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Acknowledgments

The authors have no conflicts of interest to declare.

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