Novel Technique for Dissection of Subcarinal and Main Bronchial Lymph Nodes Using a Laparoscopic Transhiatal Approach for Esophageal Cancer

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Abstract. *Background: Although metastasis to subcarinal or main bronchial lymph nodes (LNs) is common in patients with esophageal cancer, the procedure for their dissection using a laparoscopic transhiatal approach (LTHA) has not been established because of the difficulties associated with this surgery. We developed a novel and simple technique for their dissection using LTHA. Patients and Methods: An abdominal wall sealing device was placed in the upper abdomen, and four ports were inserted. After division of the gastrosplenic ligament by hand-assisted laparoscopic surgery, the esophageal hiatus was opened and carbon dioxide was introduced into the mediastinum. The pericardial adipose tissue was divided, and the pericardium was exposed. The posterior plane of the pericardium was separated and extended, and the anterior side of the subcarinal LNs and bilateral main bronchial LNs were separated. The posterior side of these LNs was then separated. Finally, while lifting these LNs like a membrane, they were resected from the bilateral main bronchi and tracheal bifurcation. The treatment outcomes of 18 patients with esophageal cancer who underwent subcarinal and main bronchial LN dissection by LTHA were compared with those of 19 patients who underwent the procedure by video-assisted thoracic surgery. Results: The number of resected subcarinal and main bronchial LNs in the two groups was not significantly different. The total operative time and total operative bleeding in the two groups was also not significantly different. Postoperative factors, such as the extubation time after surgery, frequency of postoperative complications, and the length of the postoperative hospital stay in the two groups was not significantly different. Conclusion: Our surgical procedure resulted in a good surgical view of the mediastinum, and en-bloc dissection of the subcarinal and main bronchial LNs was performed safely.*

Radial esophagectomy is currently considered the only potential treatment for patients with esophageal cancer, and recent progress in surgical and postoperative management techniques has improved treatment outcomes (1). However, esophagectomy is still associated with substantial morbidity and mortality (2-4). Although Ivor-Lewis esophagectomy is one of the most important options for esophageal cancer, its disadvantages are the pain and pulmonary complications related to thoracotomy and single-lung ventilation. These serious complications can be avoided by transhiatal esophagectomy, as first reported by Orringer and Sloan (5). Nonetheless, its disadvantage is the lack of direct exposure of the mediastinal structures, which may compromise the radial resection margins and lymphadenectomy. Since DePaula *et al*. described their laparoscopic transhiatal esophagectomy method, there have been several reports on this technique (6-8). This approach offers the reduced morbidity associated with the open transhiatal technique while providing with superior exposure of the mediastinum (8). However, because of the difficulties associated with this surgery, a procedure for mediastinal lymph node dissection using a laparoscopic transhiatal approach (LTHA) has not been established.

We started performing esophagectomy preceded by LTHA for patients with esophageal cancer in 2009 (9-11). In this method, carbon dioxide is introduced into the mediastinum from the abdominal side, and middle and lower mediastinal operations can be performed *via* a transhiatal approach. By January 2013, 125 patients with esophageal tumors had undergone our method of LTHA during various esophageal surgical procedures, including sub-total esophagectomy, middle and lower esophagectomy,

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Key Words: Laparoscopic transhiatal approach, subcarinal and main bronchial lymph node dissection, esophageal cancer.

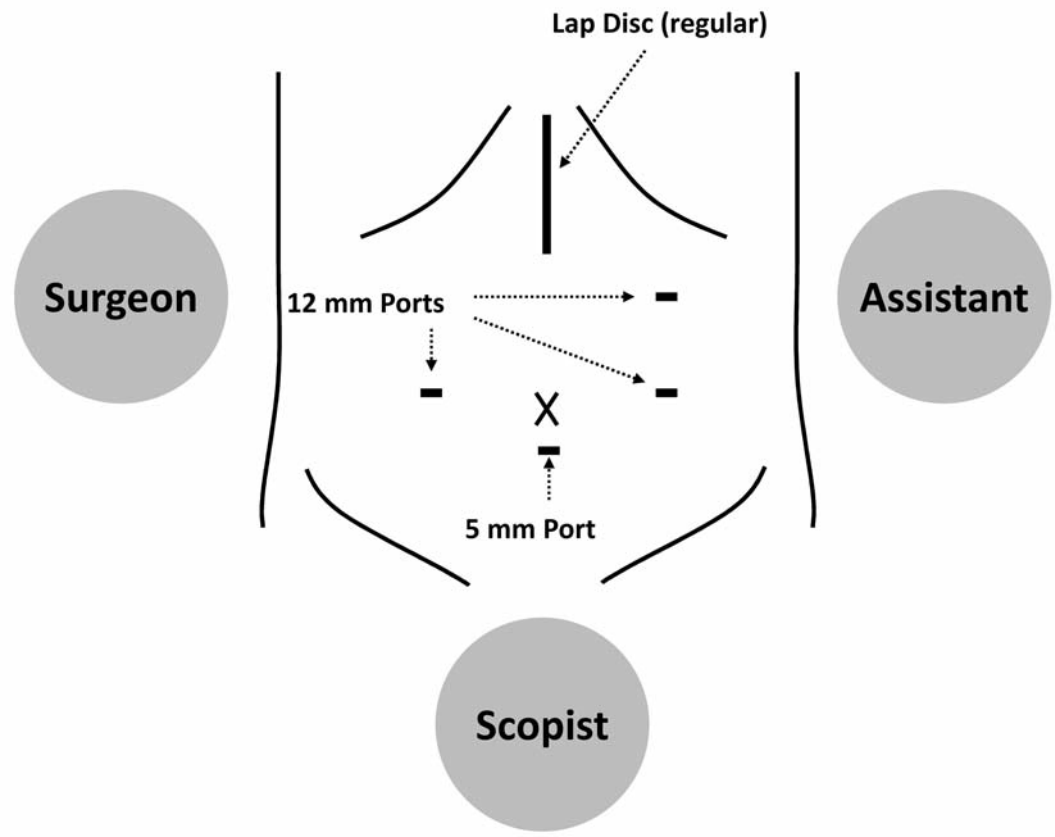

Figure 1. *Intraoperative view of the trocars and incision locations on the abdomen. A Lap Disc (regular) was placed in the upper abdomen. Three 12-mm ports were inserted, one in each flank and one in the left hypochondrium, and one 5-mm port for the videoscope was inserted in the lower abdomen.*

and tumor resection (9-12). The main advantages of this method are that thoracic procedures performed *via* right thoracotomy can be simplified. In a previous report, we demonstrated the efficacy of LTHA preceding sub-total esophagectomy, which markedly shortened the intrathoracic operative time and reduced operative bleeding without increasing the incidence of major postoperative complications (9). In addition, a good surgical view of the mediastinum was obtained and the quality of the mediastinal surgery was improved with this approach.

Previously, we described our method of *en-bloc* resection of posterior mediastinal lymph nodes including the para-aortic and left pulmonary ligament lymph nodes using LTHA in detail (10). Furthermore, we recently developed a novel and simple technique for middle mediastinal lymph node resection including the subcarinal and bilateral main bronchial lymph nodes using LTHA by extending the dissection of the posterior plane of the pericardium to the level of the tracheal bifurcation. Here, we describe our surgical technique for *en-bloc* resection of subcarinal and main bilateral bronchial lymph nodes in detail, and analyze the perioperative treatment outcomes of patients.

Patients and Methods

Surgical procedure. Patients were placed in the supine position on the operating table with both arms tucked by their sides. Initially, an abdominal operation was performed using hand-assisted laparoscopic surgery (HALS), and subsequently, middle and lower mediastinal operations were performed using a LTHA. An upper abdominal incision (70 mm) was made, and a Lap Disc (regular) (Ethicon, Cincinnati, OH, USA) was put in place (Figure 1). Three 12-mm ports were introduced, one in each flank and one in the left hypochondrium, and one 5-mm port for a flexible laparoscope was inserted into the lower abdomen (Figure 1). The operator stood at the right side of the patient and inserted the Lap Disc with their left hand, and the 12-mm port in the right flank was mainly used for surgery. The assistant stood on the left side of the patient, and the ports in the left abdomen were used to provide assistance. The scopist stood near the patient's groin. Carbon dioxide was introduced into the intra-abdominal space, and pneumoperitoneal pressure was controlled at 10 mmHg (9-12).

The operator lifted up the stomach with the left hand, and then the greater omentum, left gastroepiploic vessels, and gastrosplenic ligament were divided using an EnSeal device (45 cm shaft length; Ethicon). The esophageal hiatus was then opened, and carbon dioxide was introduced into the mediastinum (Figure 2A). The assistant inserted an Endo Retract (Autosuture Norwalk, CT, USA)

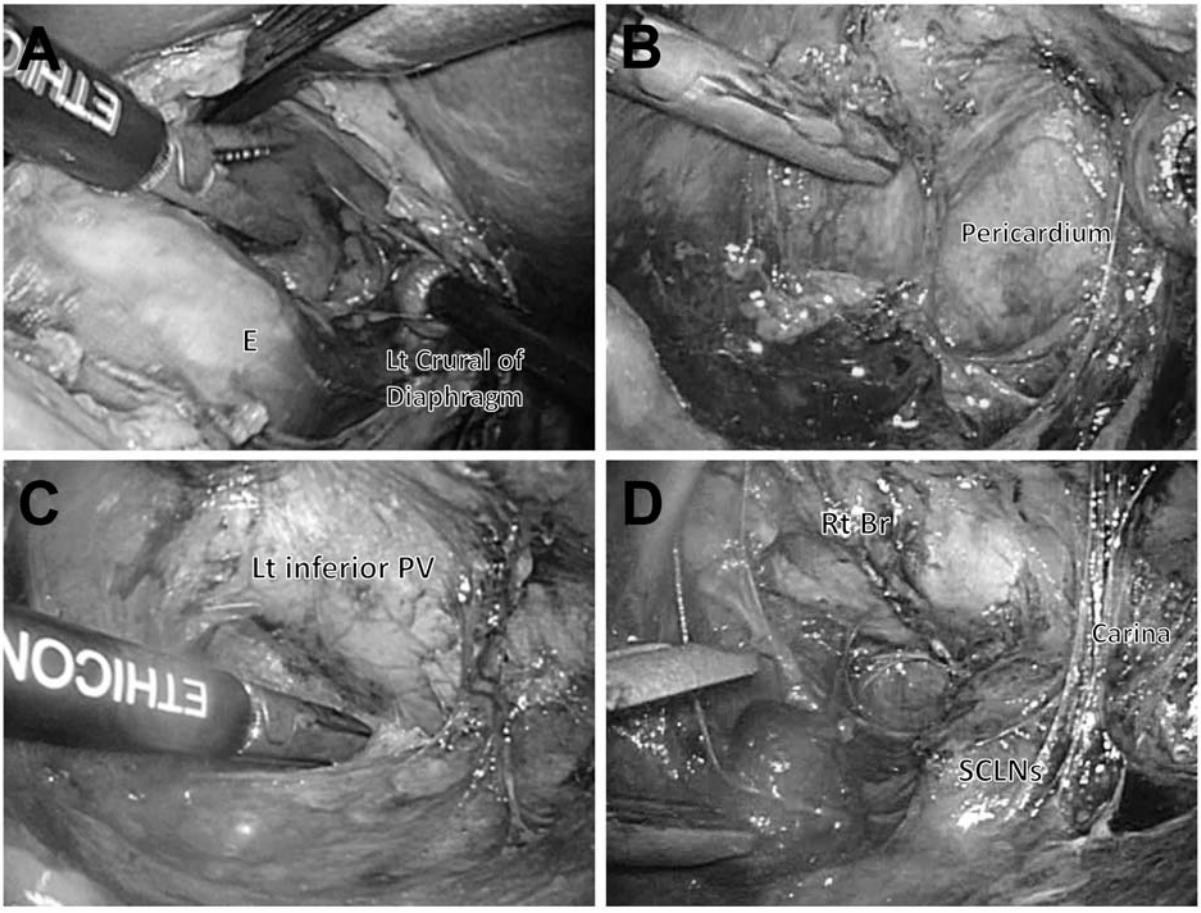

Figure 2. *A: The esophageal hiatus was divided, and carbon dioxide was introduced into the mediastinum. B: Pericardial adipose tissue was divided, and the pericardium was exposed. C: Dissection of the posterior plane of pericardium was extended to the cranial side, and the left inferior pulmonary vein was identified. D: Dissection of this plane was extended to the level of the tracheal bifurcation, leading to the identification of the subcarinal lymph nodes. E: Esophagus, Lt: left, Rt: right, PV: pulmonary vein, Br: bronchus, SCLNs: subcarinal lymph nodes.*

and a blunt tip dissector through the ports on the left side, and the working space in the mediastinum was secured with these two devices and 10 mmHg of pneumomediastinal pressure. Pericardial adipose tissue was divided, and the pericardium was exposed (Figure 2B). Dissection of the posterior plane of the pericardium was extended to the cranial side, and the left inferior pulmonary vein was identified (Figure 2C). Dissection of this plane was then extended to the level of the tracheal bifurcation with the EnSeal device, and thus, the subcarinal lymph nodes were clearly identified (Figure 2D). These lymph nodes were dissected from the tracheal bifurcation. The ventral plane of the subcarinal lymph nodes was extended bilaterally, and thus, the lymph nodes were dissected from the bilateral main bronchi. This plane was extended to the left side of the distal esophagus, and using this approach, dissection of the anterior sides of the posterior mediastinal lymph nodes was easy to perform.

Next, the adventitia of the thoracic aorta was exposed at the level of the crural diaphragm, and gentle abruption of the anterior side of the thoracic aorta to the cranial side was performed. In general, one or two roots of the proper esophageal arteries were confirmed, and we were able to divide them safely using the EnSeal device under a magnified videoscopic view. After these procedures, both the anterior and posterior sides of the posterior mediastinal lymph nodes, including the thoracic para-aortic and left pulmonary ligament lymph nodes, were dissected. While lifting these lymph nodes like a membrane, we cut them along the borderline of the left mediastinal pleura (Figure 3A). In this manner, the posterior mediastinal lymph nodes and those of left main bronchus were dissected en-bloc, as we described in a previous study (10). This incision, the borderline of the left mediastinal pleura, was extended to the left pulmonary hilum, and the lymph nodes were resected from the left main bronchus (Figure 3B).

Dissection of the dissected posterior mediastinal lymph nodes was extended towards the caudal side from the crural diaphragm to the celiac artery. Thus, the lymph nodes in the esophageal hiatus of the diaphragm, the infradiaphragmatic lymph nodes, and the lymph nodes along the celiac artery were dissected *en bloc* from the left side. The left gastric vessels were then clipped and divided, and the lymph nodes along the left gastric artery were dissected.

Next, dissection of the posterior and right sides of the distal esophagus was performed to the level of the arch of the azygos vein.

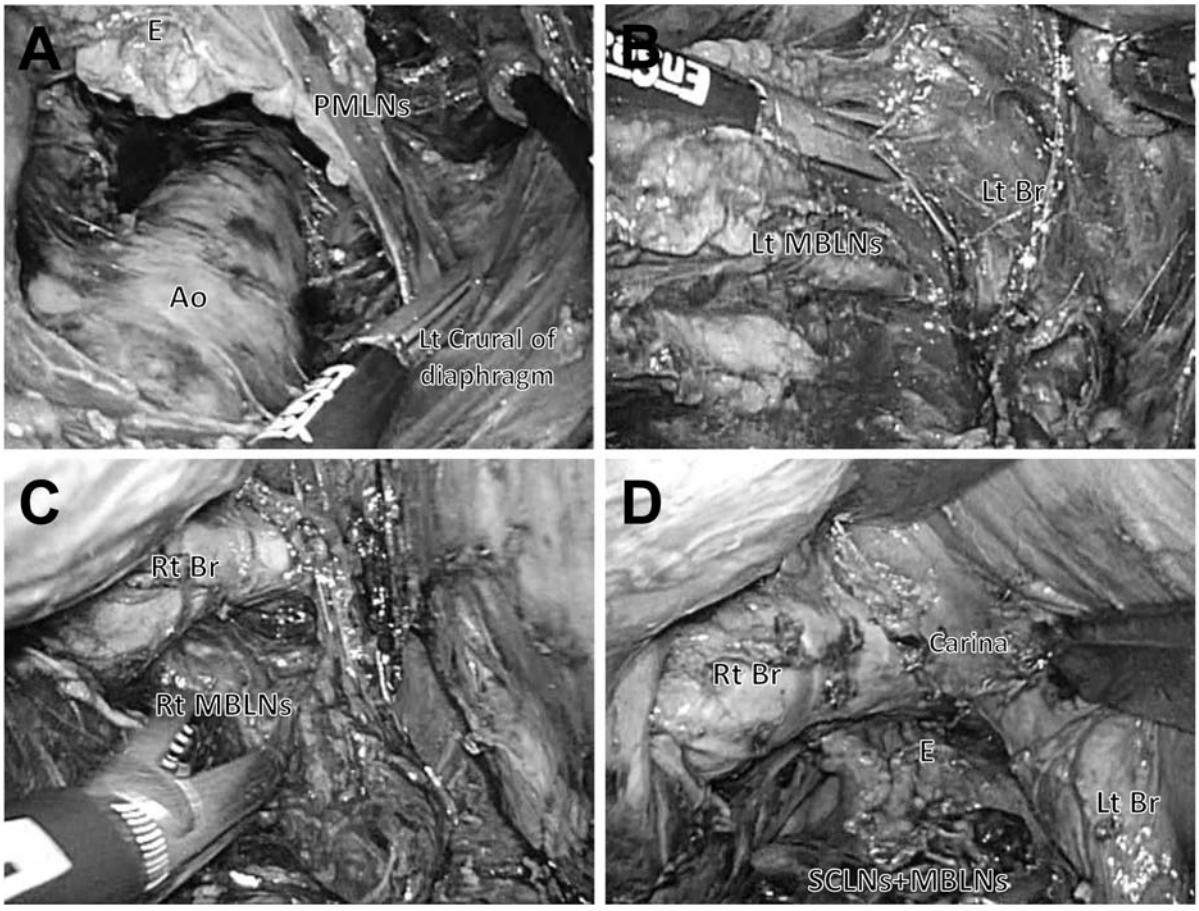

Figure 3. *A: The ventral plane of the subcarinal lymph nodes was extended bilaterally, and then both the anterior and posterior sides of the posterior mediastinal lymph nodes were resected. While lifting these lymph nodes like a membrane, they were cut along the borderline of the left mediastinal pleura. B: This incision, the borderline of the left mediastinal pleura, was extended to the left pulmonary hilum, and the lymph nodes were resected from the left main bronchus. C: While lifting the right mediastinal pleura like a membrane, an incision was made and extended to the right pulmonary hilum, and the lymph nodes were resected from the right main bronchus. D: Intraoperative view after en-bloc dissection of the subcarinal and bilateral main bronchial lymph nodes. Ao: Thoracic aorta, E: esophagus, Lt: left, Rt: right, Br; bronchus, PMLNs: posterior mediastinal lymph nodes, SCLNs: subcarinal lymph nodes, MBLNs: main bronchial lymph nodes.*

Similarly to the left side, while lifting the right mediastinal pleura like a membrane, an incision was made and extended to the right pulmonary hilum, and the lymph nodes were resected from the right main bronchus (Figure 3C). In this manner, the middle mediastinal lymph nodes including the subcarinal lymph nodes, and the lymph nodes of the right and left main bronchus were dissected *en-bloc*, and the middle and lower thoracic esophagus was completely detached from the surrounding tissue (Figure 3D).

These middle mediastinal lymph node dissection procedures are summarized in Figure 4. The anatomical position of the middle mediastinal lymph nodes is shown in Figure 4A. Pericardial adipose tissue was divided, and the pericardium was exposed. The posterior plane of the pericardium was separated and extended, and the anterior side of the subcarinal lymph nodes and those of the bilateral main bronchus was separated (Figure 4B). The posterior side of these lymph nodes was then separated. Finally, while lifting them like a membrane, they were resected from the bilateral main bronchi and tracheal bifurcation (Figure 4C).

A collar incision was then made in the neck, and cervical and upper mediastinal lymph node dissection (including lymph nodes of the cranial half of the left recurrent nerve) was performed. After the cervical esophagus was divided, the esophagus was extracted from the abdominal side. Reconstruction was then performed *via* a retrosternal route with a gastric tube. Esophagogastric anastomosis was performed by hand with a cervical approach, and the operation was finished at this phase for patients treated without a thoracic approach (group A1) (Table I).

For patients undergoing accurate upper mediastinal lymph node dissection (group A2) (Table I), five ports were inserted (the third intercostal space: one 5-mm port; the fifth intercostal space: two 12-mm ports; the seventh intercostal space: two 12-mm ports) in the left lateral-decubitus position for video-assisted thoracic surgery (VATS). Under the assistance of thoracoscopy, upper mediastinal lymph node dissection including lymph nodes of the caudal half of the left recurrent nerve and left tracheobronchial lymph nodes, which we could not reach from above or below, was performed.

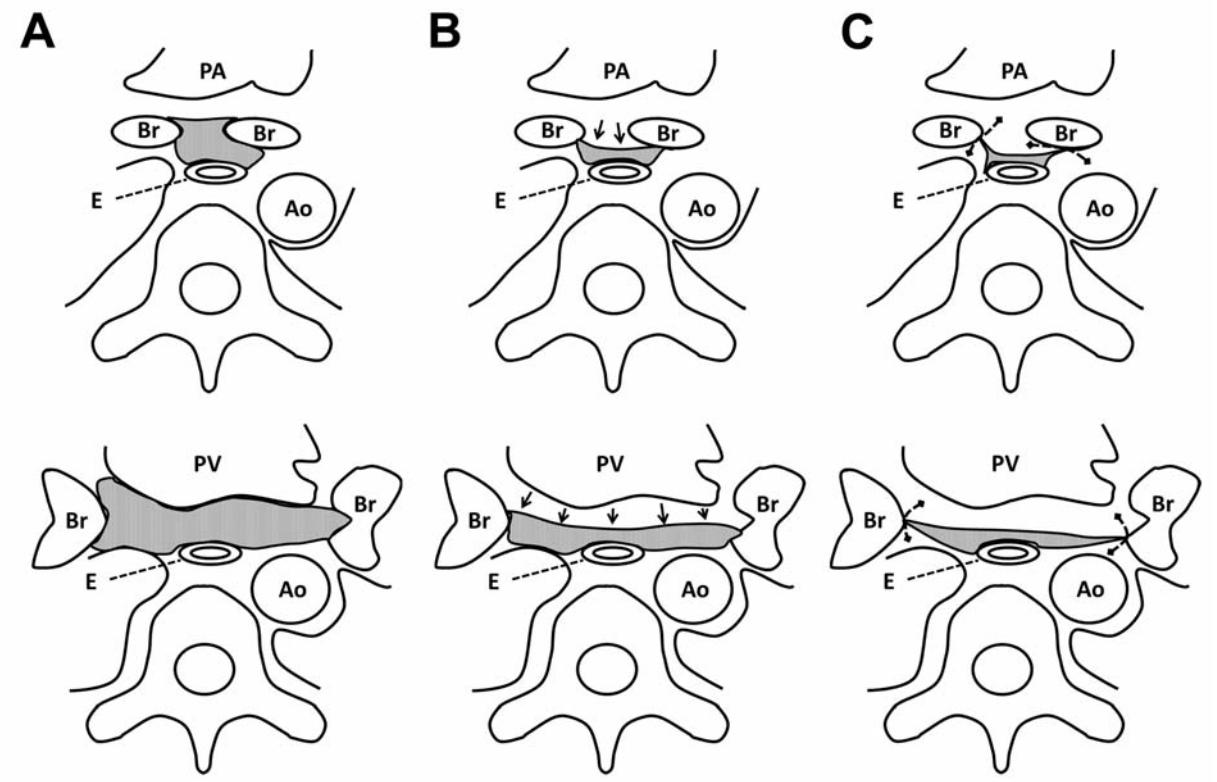

Figure 4. *En-bloc resection of the subcarinal and bilateral main bronchial lymph nodes. A: The anatomical position of the middle mediastinal lymph nodes is shown. B: The posterior plane of the pericardium was separated and extended, and the anterior side of the subcarinal and bilateral main bronchial lymph nodes was separated. C: While lifting the subcarinal and bilateral main bronchial lymph nodes like a membrane, they were resected from the bilateral main bronchi and tracheal bifurcation. Ao: Thoracic aorta, Br: bronchus, E: esophagus, PA: pulmonary artery, PV: pulmonary vein.*

Patients. Between June 2012 and January 2013, a total of 18 patients with esophageal cancer underwent subtotal esophagectomy combined with subcarinal and main bronchial lymph node dissection by LTHA (group A) and gastric tube reconstruction *via* a retrosternal route at the Division of Digestive Surgery, Department of Surgery, Kyoto Prefectural University of Medicine (Table I). Ten of these patients were treated without a thoracic approach (group A1). Upper mediastinal lymph node dissection by VATS was added for the remaining eight patients (group A2). The clinical features and perioperative treatment outcomes of group A were compared with those of 19 patients whose subcarinal and main bronchial lymph nodes were dissected by VATS (group B). These 19 patients also underwent subtotal esophagectomy preceeded by LTHA between October 2011 and September 2012. Subtotal esophagectomy and lower mediastinal lymph node dissection was initially performed in these patients. Next, cervical lymph node dissection, reconstruction *via* a retrosternal route with a gastric tube, and anastomosis *via* a cervical approach were performed. Finally, upper mediastinal, subcarinal, and main bronchial lymph node dissection was performed by VATS. The sizes of the cervical, thoracic, and abdominal incisions and the locations of the trocars used in group B patients were same as those employed in group A2. The range of mediastinal lymphadenectomy in group B was the same as that in group A2, except for the approach used for the subcarinal and main bronchial lymph nodes.

The operative indication for groups A and B was completely the same, namely operations were performed in patients with clinical T1-3, N0-3, M0 esophageal cancer based on the seventh TNM staging system (13). All patients were treated by two highly skilled surgeons, and informed consent was obtained.

A total of five patients (group A: three patients/group B: two patients) underwent three-field lymphadenectomy, and a total of 32 patients (group A: 15 patients/group B: 17 patients) underwent two-field lymphadenectomy. A total of 19 patients (group A: eight patients/group B: 11 patients) received preoperative chemotherapy involving two courses of cisplatin (80 mg/m^2/day, day 1) plus 5-fluorouracil (800 mg/m^2/day, days 1-5) (14).

To compare the backgrounds of these groups, we analyzed their clinicopathological features, such as age, gender, primary tumor location, histological type, TNM category, and pathological stage. Histopathological examinations were performed on the primary lesions and all dissected lymph nodes using serial sections. All histopathological diagnoses were made by experienced pathologists. The TNM category and pathological stage were classified according to the pTNM Pathological Classification (13). The effects of preoperative co-morbidities were analyzed using the Charlson comorbidity index (15).

To determine the efficacy of LTHA, the two groups were compared with respect to several perioperative factors, such as the total operative time, time for LTHA, operative bleeding, number of

Table I. *Grouping of patients who underwent subtotal esophagectomy for esophageal cancer according to the approach used for mediastinal lymphadenectomy.*

	Group A (n=18)		Group B (n=19)
	A1 (n=10)	A2 (n=8)	
Approach for subcarinal and main bronchial LNs	LTHA	LTHA	VATS
Thoracic	–	+	+
Upper mediastinum	CA	VATS	VATS
Lower mediastinum	LTHA	LTHA	LTHA

LTHA: Laparoscopic transhiatal approach; VATS: video-assisted thoracic surgery; CA: cervical approach; LN: lymph node.

resected subcarinal and main bronchial lymph nodes, total number of resected lymph nodes, extubation time, the length of the postoperative hospital stay, and the frequency of postoperative complications, such as respiratory complications, anastomotic leakage, and recurrent nerve palsy. Postoperative respiratory complications were defined as those involving major respiratory insufficiencies, *i.e.* a need for reintubation or severe pneumonia. Recurrent nerve palsy was diagnosed by otolaryngologists using laryngoscopy when extubation was performed.

Statistical analysis was carried out using Student's *t*-test and Fisher's exact test. Differences were considered significant when the *p*-value was less than 0.05. All analyses were performed using statistical software (JMP, version 5; SAS Institute Inc., Cary, NC, USA).

Results

Thirty-seven patients with esophageal cancer who underwent subtotal esophagectomy combined with gastric tube reconstruction *via* a retrosternal route were divided into two groups according to the approach used for subcarinal and main bronchial lymph node dissection, *i.e.* by LTHA (18 patients, group A) and VATS (19 patients, group B) (Table I). There were no significant differences between the background clinicopathological parameters of the two groups (such as age, gender, primary tumor location, histological type, TNM category, pathological stage, or Charlson comorbidity index (Table II). In group A1 in particular, the percentage of patients who underwent subtotal esophagectomy by LTHA without a thoracic approach that were aged 70 years or older was 70%. Furthermore, five patients in this group had a Charlson comorbidity index of more than 2, and all of these patients had chronic pulmonary disorder. These results indicate that subtotal esophagectomy without a thoracic approach was mainly performed in high-risk patients.

We then compared intraoperative factors. The number of resected subcarinal and main bronchial lymph nodes in group A and group B was not significantly different (group A: 7.6±4.2/group B: 8.5±5.8) (Table III). The time for LTHA was slightly longer in group A (105.3±18.9 minutes) than in group B (92.5±32.8 minutes), but there were no significant differences. The total number of resected lymph nodes, total operative time, and total operative bleeding were compared between group A2 and group B because their surgical incisions and the range of mediastinal lymphadenectomy were exactly the same, except for the approach used for subcarinal and main bronchial lymph node dissection. The total number of resected thoracic lymph nodes in the two groups was not significantly different (group A2: 52.0±19.3, group B: 42.1±11.6). The total operative time was slightly longer in group A2 (396.6±44.1 min) than in the group B (365.3±50.4 min), but there were no significant differences (Table III). Total operative bleeding in the two groups was not significantly different (group A2: 264.6±189.6 ml, group B: 275.2±173.4 ml). These results suggest that LTHA can maintain the quality of lymph node dissection without increasing operative bleeding.

Next, we compared postoperative factors between group A and group B (Table IV). The extubation time after surgery in the two groups was not significantly different. The frequency of postoperative respiratory complications, anastomotic leakage, and recurrent nerve palsy in the two groups was not significantly different. The length of the postoperative hospital stay in the two groups was not significantly different. Furthermore, a comparison between group A2 and group B showed that none of these factors were significantly different. These results suggest that subcarinal and main bronchial lymph node dissection by LTHA can be used without increasing the risk of major complications.

Discussion

Subcarinal lymph node metastasis is common in patients with esophageal cancer, and the frequency of such metastasis in patients with esophageal squamous cell carcinoma (ESCC) has been reported to be between 10.0% and 25.0% (16-20). Huang *et al.* investigated the frequency of subcarinal lymph node metastasis in patients with ESCC in different tumor locations, and found that it was 7.4% in upper thoracic, 18.8% in middle thoracic, and 10.5% in lower thoracic locations (21). Furthermore, Shimada *et al.* reported that the presence of

Table II. *Comparison of the background clinicopathological parameters of patients with esophageal cancer who underwent subcarinal and main bronchial lymph nodes dissection by laparoscopic transhiatal approach (group A) and video-assisted thoracic surgery (group B).*

Variables		Group A			Group B	*p*-Value
		A1	A2	Total		(Group A *vs*. group B)
Age	≥70 years	7	1	8	8	1.000
	<70 years	3	7	10	11	
Gender	Male	8	7	15	18	0.340
	Female	2	1	3	1	
Location of the primary tumor	Ut	2	1	3	4	1.000
	Mt-Lt	8	7	15	15	
Histological type	SCC	10	8	18	17	0.487
	Other	0	0	0	2	
pT Category	pT1-2	4	5	9	14	0.184
	pT3-4	6	3	9	5	
pN Category	pN0	6	3	9	12	0.515
	pN1-3	4	5	9	7	
pM Category	pM0	9	8	17	18	1.000
	pM1	1	0	1	1	
Pathological stage	0-I	4	1	5	8	0.495
	II-IV	6	7	13	11	
Charlson comorbidity index	≤ 2	5	7	12	17	0.125
	>2	5	1	6	2	

Ut: Upper thoracic esophagus; Mt: middle thoracic esophagus; Lt: lower thoracic esophagus; SCC: squamous cell carcinoma.

Table III. *Comparison of the intraoperative parameters of patients with esophageal cancer who underwent subcarinal and main bronchial lymph node (LN) dissection by laparoscopic transhiatal approach (LTHA) (group A) and video-assisted thoracic surgery (group B).*

Variables	Group A			Group B	*p*-Value
	A1	A2	Total		
Number of resected subcarinal and main bronchial LNs	6.6±2.7	8.8±5.4	7.6±4.2	8.5±5.8	0.599*
Total number of resected LNs	29.3±14.1	52.0±19.3	39.4±19.8	42.1±11.6	0.110**
Total operative time (min)	218.6±27.5	396.6±44.1	297.7±97.4	365.3±50.4	0.143**
Time for LTHA (min)	101.0±17.1	120.0±31.1	105.3±18.9	92.5±32.8	0.170*
Total operative bleeding (ml)	138.8±76.2	264.6±189.6	194.7±148.4	275.2±173.4	0.890**

*Group A (total) *vs*. group B; *group A2 *vs*. group B. Data are means±SD.

subcarinal lymph node metastasis was an independent risk factor for poorer survival (17). These reports suggested the importance of the dissection of these nodes in patients with esophageal cancer. However, subcarinal lymph nodes are very difficult to dissect in transhiatal esophagectomy.

We began performing esophagectomy preceded by the LTHA for patients with esophageal cancer in 2009 (9-11). Using this method, thoracic procedures performed *via* right thoracotomy can be simplified, and the duration of one-lung ventilation can be shortened (9). The major advantage of our surgical procedure is that it enables the posterior mediastinal lymph nodes, including the para-aortic and left pulmonary ligament lymph nodes, to be approached easily (10). The left side of the mediastinum is a difficult space to approach *via* right thoracotomy; therefore, complete resection of these nodes carries a risk of serious complications. As we previously reported, we developed a novel technique for posterior mediastinal lymph node dissection (10). In this method, gas supply during dissection of the mediastinum makes the planes between the esophagus and the surrounding organs easy to identify and separate. Accordingly, separation of the anterior and posterior sides of the posterior mediastinal lymph nodes is easy to perform, and lifting these lymph nodes like a membrane allows the border of the left mediastinal pleura to be clearly identified, enabling the performance of *en-bloc* dissection (10).

Table IV. *Comparison of the postoperative parameters of patients with esophageal cancer who underwent subcarinal and main bronchial lymph node dissection by laparoscopic transhiatal approach (group A) and video-assisted thoracic surgery (group B).*

Variables		Group A			Group B	*p*-Value	
		A1	A2	Total		Group A *vs.* group B	Group A2 *vs.* group B
Extubation time after surgery	0 POD	10	7	17	17	1.000	1.000
	1 POD	0	1	1	2		
Post-operative complications	Yes	3	4	7	11	0.330	1.000
	No	7	4	11	8		
Respiratory complications	Yes	1	2	3	1	0.340	0.675
	No	9	6	15	18		
Anastomotic leakage	Yes	0	0	0	3	0.230	0.532
	No	10	8	18	16		
Recurrent nerve palsy	Yes	2	4	6	7	1.000	0.210
	No	8	4	12	12		
Postoperative hospital stay (days)		29.5±15.5	36.5±16.6	32.6±15.9	33.4±13.0	0.874	0.602

POD: Post-operative day. Data are means±SD.

The surgical procedure for posterior mediastinal lymph node dissection using LTHA consists of four steps: i) identification of an appropriate plane, ii) extension of the same plane, iii) lifting of the lymph nodes like a membrane, and iv) cutting the border between the lymph nodes and surrounding organs. By applying this surgical concept to middle mediastinal lymph node dissection, we developed a novel and simple technique for the resection of subcarinal and bilateral main bronchial lymph nodes using LTHA. The important steps in this procedure are the identification of the posterior plane of pericardium and its extension. This plane continues to the anterior side of the subcarinal lymph nodes and bilateral main bronchial lymph nodes. In most cases, these nodes are easily identified because of anthracosis. By extending the anterior plane of the thoracic aorta, the posterior side of the main bronchial lymph nodes can be also separated. Finally, while lifting them like a membrane, these lymph nodes are resected from the bilateral main bronchi and tracheal bifurcation, and in this manner, *en-bloc* dissection of the subcarinal and bilateral main bronchial lymph nodes can be performed simply and reasonably. All procedures such as separation, cutting, and coagulation can be performed using the EnSeal device. The tip of the EnSeal blade is not sharp; therefore, it is suitable for safe separation. We mainly use the long shaft length (45 cm) EnSeal, which enables us to perform upper and middle mediastinal operations from the abdominal side. In this method, the working space in the mediastinum can be secured by three factors: 10 mmHg of pneumomediastinal pressure, Endo Retract, and traction by the operator's left hand. Therefore, cooperation with the assistant and traction in the appropriate direction are extremely important.

Although there have been several reports on laparoscopic transhiatal esophagectomy, the procedure for mediastinal lymph node dissection has not been established (6-8). Our procedure enables for middle and lower mediastinal regional lymph node dissection using LTHA. From a cervical approach, upper mediastinal lymph nodes can be dissected except for the caudal half of the left recurrent nerve lymph nodes and left tracheobronchial lymph nodes. To dissect these nodes, which we could not reach from above or below, we performed thoracoscopic surgery. A thoracic operation was not performed in some cases, such as elderly patients, patients with respiratory disturbances, and patients with superficial carcinoma without lymph node metastasis, to reduce surgical invasiveness. In the future, the development of surgical devices may enable transhiatal esophagectomy with total mediastinal regional lymph node dissection for esophageal cancer. We believe our procedure has the potential to contribute to this approach; however, long-term outcomes, such as recurrence and survival, need to be analyzed.

In conclusion, our surgical procedure, LTHA preceding esophagectomy, resulted in a good surgical view of the mediastinum, and en-bloc dissection of subcarinal and main bronchial lymph nodes was performed safely.

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