

Three-field Dissection for Squamous Cell Carcinoma in the Thoracic Esophagus

Hiomasa Fujita, MD, Susumu Sueyoshi, MD, Toshiaki Tanaka, MD
and Kazuo Shirouzu, MD

An esophageal cancer has frequent metastasis in the cervical and upper mediastinal lymph nodes, in particular along the recurrent nerves. Cervicothoracoabdominal three-field dissection is the most radical and rational lymphadenectomy procedure based on this evidence. During three-field dissection, the nodes along the recurrent nerves from the neck to the mediastinum are more meticulously resected than during any other procedure of radical lymphadenectomy. A consensus has been obtained that complete resection of the recurrent nerve nodes improves the survival rates of patients with cancer in each of the various locations of the thoracic esophagus, and that resection of the supraclavicular and internal jugular nodes improves the survival rates of patients with cancer in the upper thoracic esophagus. There is, however, still some controversies over whether or not resection of the supraclavicular and internal jugular nodes improves the survival rates of patients with cancer in the middle or lower thoracic esophagus. Moreover, there remains many controversies over the indication for three-field dissection regarding metastasis-positivity in the lymph nodes, the numbers of the metastasis-positive nodes, the stage, surgical risks and other aspects. Large randomized prospective studies are needed to accumulate conclusive evidence for the benefits of three-field dissection. (Ann Thorac Cardiovasc Surg 2002; 8: 328–35)

Key words: esophageal cancer, radical lymphadenectomy, three-field dissection, two-field dissection

Introduction

The history of cervicothoracoabdominal three-field dissection started from the reports by Kinoshita et al.¹⁾ in 1976 and Sannohe et al.²⁾ in 1981. They emphasized that esophageal cancer had frequent metastasis in the recurrent nerve nodes and in the supraclavicular nodes. Based on these two reports, many surgeons adopted three-field dissection for cancer in the thoracic esophagus. The inquiring research of the Japanese Society for Esophageal Diseases (JSED) by Isono et al. showed that three-field

dissection was performed in 35 of 96 major Japanese hospitals from 1983 to 1986.³⁾ During the past two decades, three-field dissection has become recognized by many surgeons, not only in Japan³⁻⁹⁾ but also worldwide,¹⁰⁻¹²⁾ as an option in radical surgery for cancer in the thoracic esophagus.

In the Consensus Conference of the International Society for Diseases of the Esophagus (ISDE) in Munich in 1994,¹³⁾ the experts determined three-field dissection to be the most radical lymphadenectomy and they agreed that there was increasing evidence that radical lymphadenectomy for esophageal cancer might have a beneficial effect for the patient through:

- (1) staging information, treatment planning
- (2) prevention of local recurrence, and
- (3) better long-term survival in undefined subgroups.

In the Consensus Conference at the 6th World Congress of the ISDE in Milan in 1995,¹⁴⁾ panelists agreed

From Department of Surgery, Kurume University School of Medicine, Fukuoka, Japan

Received October 30, 2002; accepted for publication November 2, 2002.

Address reprint requests to Hiromasa Fujita, MD: Department of Surgery, Kurume University School of Medicine, 67 Asahi-machi, Kurume City, Fukuoka 830-0011, Japan.

Table 1. Terminology of the regional lymph nodes in esophageal cancer

ISDE	JSED	Numbering
<i>Cervical nodes</i>		
–	Superficial cervical (R, L)	100
Cervical paraesophageal (R, L)	Cervical paraesophageal (R, L)	101
Cervical paratracheal (R, L)		
Internal jugular (R, L)	Deep cervical (R, L)	102
–	Peripharyngeal (R, L)	103
Supraclavicular	Supraclavicular	104
<i>Thoracic nodes</i>		
Periesophageal	Upper thoracic paraesophageal	105
	Middle thoracic paraesophageal	108
	Lower thoracic paraesophageal	110
Right recurrent nerve	Recurrent nerve (R)	106 recR
Left paratracheal	Recurrent nerve (L)	106 recL
Right paratracheal	Pretracheal	106 pre
Infraaortic arch	Tracheobronchial (L)	106 tbL
Infracarinal	Bifurcational	107
	Main bronchus (R, L)	109
Lower posterior mediastinal	Supradiaphragmatic	111
	Posterior mediastinal	112
–	Ligamentum arteriosum (Botallo's node)	113
–	Anterior mediastinal	114
–	Esophageal hiatus	20
<i>Abdominal nodes</i>		
Cardiac (R, L)	Cardiac (R, L)	1, 2
Lesser curvature	Lesser curvature	3
Greater curvature	Greater curvature	4
Left gastric	Left gastric artery	7
Common hepatic	Common hepatic artery	8
Splenic	Splenic artery	11
Coeliac	Coeliac artery	9
Abdominal paraaortic	Abdominal paraaortic	16
–	Infradiaphragmatic	19

recR: right recurrent nerve, recL: left recurrent nerve, pre: pretracheal, tbL: left tracheobronchial

cervical lymphadenectomy should be performed in patients with supracarinal cancers. However, no consensus could be obtained for subcarinal cancers, where cervical lymphadenectomy for cancers in the middle third was considered by panelists optional.

There are, even now, controversies over the survival benefit and the indication of three-field dissection for esophageal cancer.¹⁵⁻¹⁷⁾ The main reason is that there have been few randomized control trials to evaluate the efficacy of this procedure.¹⁸⁾ Here, we have reviewed the terminology, the incidence of metastasis to the cervical nodes, the survival benefit, the indication, and the mortality and morbidity in three-field dissection for esophageal cancer.

Terminology

a) Terminology of the regional lymph nodes of the esophagus

In order to discuss scientifically the incidence and pattern of lymph node metastasis, and the extent of lymphadenectomy, the terminology of the regional lymph nodes of esophageal cancer was defined by the ISDE¹⁹⁾ and by the JSED (Table 1).²⁰⁾

The cervical paraesophageal and paratracheal nodes belong to the recurrent nerve chain nodes. In the right side, the nodes—the cervical paraesophageal nodes—are frequently situated posterior to the recurrent nerve, while in the left side, the nodes—the cervical paratracheal nodes—

Table 2. Lymph nodes (N) grading classification (JSED 1999)

Cancer location	N1	N2	N3	N4
Cervical	101, 104	102, 106 rec	100, 103, 105, 106 tbL, 107, 108	106 pre, 106 tbR, 109, 110, 111, 112, 113, others
Upper thoracic	105, 101, 106 rec	104, 106 tbL, 107, 108, 109	102 mid, 106 pre, 106 tbR, 110, 111, 112, 1, 2, 3, 7	100, 102 up, 103, 113, 114, 4, 5, 6, 8, 9, others
Middle thoracic	108, 106 rec	101, 105, 106 tbL, 107, 109, 110, 1, 2, 3, 7	104, 111, 112, 20	100, 102, 103, 106 pre, 106 tbR, 113, 114, 4, 5, others
Lower thoracic	110, 1, 2	106 rec, 107, 108, 109, 111, 112, 3, 7, 20	101, 105, 106 tbL, 9, 19	100, 102, 103, 104, 106 pre, 113, 106 tbR, 114, 4, others
Abdominal	1, 2, 3, 20	110, 111, 7, 9, 19, (4, 10, 11)	108, 5, 8, (112)	100, 101, 102, 103, 104, 105, 106, 107, others

are frequently situated anterior to the recurrent nerve. Therefore, the right cervical paraesophageal nodes can be completely resected through a thoracic approach, while the left paratracheal nodes can not be completely resected through a thoracic approach. However, the left cervical paratracheal nodes can be resected through a cervical approach during cervical anastomosis. Therefore, the difference between modern two-field dissection¹⁵⁾—total mediastinal dissection¹³⁾—and three-field dissection is only in the procedure resecting the internal jugular nodes and the supraclavicular nodes.

b) Lymph node grading and compartment classification

The lymph node (N) grading was authorized by the JSED (Table 2) based on the incidence of metastasis in each cluster of the regional lymph nodes of the esophagus revealed by three-field dissection.²⁰⁾ The theoretical framework of the lymph node grading is based on the compartment classification,^{21,22)} which was defined considering the clinical value of each cluster of the lymph nodes assessed according to the incidence of metastasis in those nodes and the survival rates after resection of those nodes when metastasis was positive.

c) Extent of lymphadenectomy

The extent of lymphadenectomy was defined by the ISDE based on the historical background¹³⁾ and by the JSED based on the lymph node grading.²⁰⁾

Figure 1 illustrates the extent of radical lymphadenectomy agreed by the experts in the Consensus Conference of the ISDE in Munich in 1994.¹³⁾ The extent of lymphadenectomy was classified into four procedures; standard, extended, total mediastinal, and three-field lymphadenectomy.

In the Guidelines of the JSED,²⁰⁾ the extent of lymph

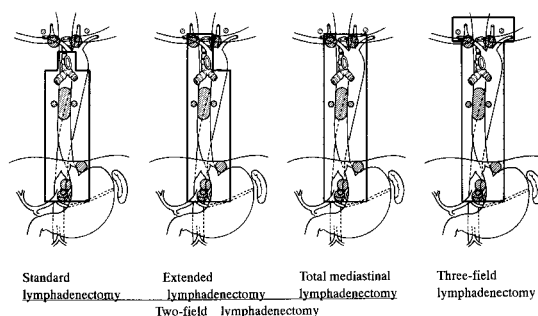


Fig. 1. Extent of radical lymphadenectomy for cancer of the thoracic esophagus (ISDE, 1994).

phadenectomy was classified into four groups; dissection 0 (D0), D1, D2, and D3. D0 means no lymph node dissection or incomplete dissection of the N1. D1, D2, and D3 mean complete dissection of the N1, 2, and 3, respectively. The extent of lymphadenectomy was defined in each cancer location. For cancer in the upper or middle thoracic esophagus, three-field dissection is defined as D3 lymphadenectomy, and total mediastinal lymphadenectomy¹³⁾—modern two-field dissection¹⁵⁾—is defined as D2 lymphadenectomy, while for cancer in the lower thoracic esophagus, both three-field dissection and modern two-field dissection are defined as D3 lymphadenectomy.

Incidence of Metastasis to the Regional Lymph Nodes from Cancer in the Thoracic Esophagus

Three-field dissection revealed that lymph node metastasis from esophageal cancer widely spread from the neck to the abdomen. Table 3 shows the incidence of metastasis

Table 3. Incidence of metastasis in the regional lymph nodes²³ (%)

	Upper (79)	Middle (451)	Lower (185)	Total (715)
<i>Cervical nodes</i>				
Cervical paraesophageal R	13	6	3	6
L	3	2	1	2
Cervical paratracheal R	7	2	1	3
L	4	4	4	4
Internal jugular R	6	4	1	3
L	9	5	7	6
Supraclavicular R	7	5	3	4
L	8	6	1	5
<i>Thoracic nodes</i>				
Periesophageal				
Upper thoracic	22	10	3	10
Middle thoracic	23	19	16	19
Lower thoracic	14	11	22	15
Recurrent nerve R	50	18	11	21
L*	32	16	11	16
Preparatracheal†	13	10	6	9
Infraaortic arch	10	3	3	4
Infracarinal				
Bifurcational	13	12	8	11
Main bronchus R	11	4	5	5
L	4	6	4	5
Lower posterior mediastinal				
Posterior mediastinal	6	8	10	8
Supradiaphragmatic	2	3	6	3
<i>Abdominal nodes</i>				
Cardiac R	7	20	36	23
L	7	16	26	17
Lesser curvature	3	12	29	16
Greater curvature	0	3	2	2
Left gastric	2	18	32	20
Common hepatic	0	3	7	4
Splenic	0	2	9	4
Coeliac	0	7	10	8
Abdominal paraaortic	0	4	7	5

Parentheses: number of patients, *left paratracheal nodes, †right paratracheal nodes according to ISDE classification

sis in the regional lymph nodes in 715 patients with cancer in the thoracic esophagus who underwent three-field dissection in 10 major centers in Japan from 1985 to 1989.²³⁾

Table 4 summarizes the incidence of metastasis to the cervical nodes at surgery. Metastasis in the cervical nodes were found in around 30% of patients who underwent three-field dissection, in around 45% of patients with cancer in the upper thoracic esophagus, in around 30% of those with cancer in the middle thoracic esophagus, and in around 20% of those with cancer in the lower thoracic esophagus. In most reports, the cervical paraesophageal and paratracheal nodes, and the supra-

clavicular and internal jugular nodes were not separately distinguished within the cervical lymph nodes.^{4-7,11,25)} Fujita et al. pointed out that the incidence of metastasis to the supraclavicular and internal jugular nodes—excluding the cervical paraesophageal and paratracheal nodes—from cancer in the lower thoracic esophagus was only 5%.²⁴⁾

Survival Benefit

In the historical studies,⁶⁾ it was reported that the five-year-survival rates after three-field dissection were better than those after two-field dissection. On the other hand,

Table 4. Incidence of metastasis to the cervical lymph nodes according to cancer location

Authors	Upper (%)	Middle (%)	Lower (%)	Total(%)
Isono (1990) ⁴⁾	42	28	19	33
Kato (1991) ⁵⁾	47	41	23	37
Akiyama (1994) ⁶⁾	46	29	27	31
Nishimaki (1994) ⁷⁾	44	14	15	16
Fujita (1994) ^{8,24)}	40	22	4	19
Lerut (1999) ^{†11)}	–	31	30	30
Ando (2000) ²⁵⁾	39	26	24	28
Altorki (2002) ^{‡12)}	13	59	33	36

*Sum of the incidence of metastasis at surgery and recurrence after surgery only in the supraclavicular and the internal jugular nodes, †squamous cell carcinoma: 22/37 (60%), adenocarcinoma 15/37 (41%), ‡the incidence of metastasis in the cervicothoracic nodes including the recurrent nodes, supraclavicular nodes, and deep cervical nodes, squamous cell carcinoma: 32/80 (40%), adenocarcinoma: 48/80 (60%)

Table 5. Five-year-survival rates after two-field, and after three-field dissection

Authors	Two-field (%)	Three-field (%)	Comment
Isono (1991) ³⁾	27 (n=2,671)	34 (n=1,740)	p<0.001, 96 hospitals, 1983-86
Kato (1991) ¹⁸⁾	34 (n=73)	49 (n=77)	p<0.01, RCT*, 1985-89
Kakegawa (1991) ²⁶⁾	36 (n=159)	40 (n=705)	ns, 10 hospitals, 1985-89
Iizuka (1992) ²⁷⁾	45 (n=521) [†]	47 (n=459) [†]	ns, 32 hospitals, 1988-89
Fujita (1993) ²⁸⁾	33 (n=49) [‡]	49 (n=38) [‡]	p<0.10, 2 hospitals, 1985-89
	23 (n=67) [§]		p<0.05
Akiyama (1994) ⁶⁾	38 (n=283)	53 (n=261)	p<0.001, historical, 1973-93
Watanabe (2000) ¹⁵⁾	55 (n=98)	48 (n=141)	ns, 1988-94
Altorki (2002) ¹²⁾	–	51 (n=80)	1994-2001

RCT* randomized control trial, †four-year-survival rates, ‡two-field or three-field dissection in the Kurume University Hospital, §en bloc esophagectomy in the Technical University of Munich, ||cancer in the upper thoracic esophagus was excluded

in the contemporary studies both in the single institute studies and in the multi-institute studies,^{3,26-28)} there has been a controversy over whether or not three-field dissection improved the long-term survival rates compared to two-field dissection (Table 5). Kato et al.¹⁸⁾ reported based on their randomized control trial that three-field dissection was superior to two-field dissection. However, Watanabe et al. asserted that the five-year-survival rates after modern two-field dissection–total mediastinal lymphadenectomy–in which the recurrent nerve nodes were completely resected similar to three-field dissection were the same as those after three-field dissection.¹⁵⁾

Indications

a) Cancer location

In the Consensus Conference at the 6th World Congress of the ISDE in Milan in 1995,¹⁴⁾ the panelists agreed that cervical lymphadenectomy should be performed in pa-

tients with cancer in the upper thoracic esophagus. However, a consensus was not obtained for its indication for cancer in the middle or lower thoracic esophagus. Baba et al. concluded that three-field dissection should be indicated for cancer in the upper or middle thoracic esophagus.⁸⁾ Fujita et al. reported that three-field dissection should be indicated for patients with lymph node metastasis from cancer in the upper or middle thoracic esophagus.⁹⁾ On the other hand, Tsurumaru et al. asserted that three-field dissection should be indicated for all cancer in any location of the thoracic esophagus.²⁹⁾

b) Lymph node metastasis (N)

Isono et al. reported that three-field dissection improved the survival rates of patients both with and without lymph node metastasis.³⁾ Tabira et al. concluded that three-field dissection should be indicated for patients with metastasis in one to four lymph nodes.³⁰⁾ Shiozaki et al. reported that cervical lymphadenectomy could be omitted for pa-

Table 6. The hospital mortality and morbidity rates after two-field, and after three-field dissection

Authors	Mortality rate (%)		Morbidity rate (%)		Comment
	Two-field	Three-field	Two-field	Three-field	
Isono (1991) ³⁾	5	3	–	–	1983-89
Kato (1991) ¹⁸⁾	12	3	75	62	1985-89
Baba (1994) ⁸⁾	–	10	–	65	1982-90
Fujita (1995) ⁹⁾	3	2	–	–	1986-91
Lerut (1999) ¹¹⁾	–	0	–	–	1992-93
Altorki (2002) ¹²⁾	–	5*	–	46	1994-2001
Udagawa (2001) ³³⁾	3	3	–	–	historical

*the mortality rate within 30 days

tients with cancer in the middle or lower thoracic esophagus when no metastasis in the recurrent nerve nodes was found.³¹⁾

c) T category

Isono et al. concluded that three-field dissection should be indicated for cancer with a depth of invasion from T1b to T3.³⁾

d) Stage (UICC)

Lerut et al.¹¹⁾ reported that this procedure should be indicated for patients at stage IIB to stage IV in the UICC³²⁾ stage classification.

In short, there is a consensus over the indication of three-field dissection for cancer in the upper thoracic esophagus. Its indication for cancer in the middle thoracic esophagus is accepted by most Japanese surgeons, but not by Western surgeons. The indication for cancer in the lower thoracic esophagus is controversial also in Japan. Cancers with a depth from T1b to T3 are indicated for three-field dissection. The indications for three-field dissection regarding metastasis-positivity in the lymph nodes or the numbers of the metastatic lymph nodes are controversial.

Operative Results

a) Mortality rates

The hospital mortality rate was 0 to 10% after three-field dissection with no difference from that after two-field dissection (Table 6).^{3,8,9,11,12,18,33)} There has been few reports to indicate that the overall morbidity rates after three-field dissection were higher than those after two-field dissection,¹⁸⁾ although the higher incidence of particular complications after three-field dissection has been frequently

described.

b) Postoperative complications

Isono et al.³⁾ and Udagawa et al.³³⁾ reported that recurrent nerve paralysis increased after three-field dissection. Baba et al.³⁴⁾ reported that permanent recurrent nerve paralysis increased after three-field dissection, and it caused deterioration of the quality of life (QOL) after surgery. Fujita et al.⁹⁾ reported that although the incidence of temporary recurrent nerve paralysis increased after three-field dissection, the QOL after surgery was not different from that after two-field dissection. They also reported that anastomotic leakage and tracheobronchial ischemic lesions were more common after three-field dissection than after two-field dissection. Udagawa et al.³³⁾ reported that pulmonary edema/adult respiratory distress syndrome (ARDS) and pulmonary embolism increased after three-field dissection.

In short, the morbidity including recurrent nerve paralysis and other pulmonary complications increased after three-field dissection, while the mortality rates did not increase.

Guidelines for the Management for Esophageal Cancer

The Guidelines for the Management for Esophageal Cancer, published by the JSED in 2002,³⁵⁾ state that three-field dissection is recommended for esophageal cancer, in particular cancer in the upper thoracic esophagus, based on the incidence of metastasis spreading from the cervical nodes to the abdominal nodes. However, there remains controversy over which is better lymphadenectomy for cancer in the middle or lower thoracic esophagus, two-field or three-field dissection, because of the lower inci-

dence of metastasis in the supraclavicular nodes than in the cervical paraesophageal and paratracheal nodes which are considered to be resected through a thoracic approach. There is also controversy over survival benefits, as to whether there is any difference between two-field and three-field dissection, and whether there are more survival benefits from three-field dissection.

On the other hand, the Guidelines, published by the Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland, the British Society of Gastroenterology, and the British Association of Surgical Oncology in 2002,³⁶⁾ state that the principle aims of lymphadenectomy should be to minimize staging error, reduce locoregional risks of recurrence and, by increasing the number of patients undergoing an R0 resection, increase the five-year survival rate. Although there is considerable enthusiasm for the performance of lymphadenectomy in three fields in Japan, this approach has not been adopted widely by Western surgeons. A number of studies have shown that two-field dissection can be carried out with no significant increase in operative morbidity and mortality. Conversely, although the three-field dissection is advocated in Japan for squamous cell carcinoma, its benefits may simply reflect the reduction in staging error, as nearly a quarter of all Japanese patients will have cervical lymph node metastasis. It must be recognized that the operation has been associated with a higher risk of postoperative morbidity.

Conclusion

Esophageal cancer has frequent metastasis in the cervical and upper mediastinal lymph nodes, in particular along the recurrent nerves. Cervicothoracoabdominal three-field dissection is the most radical and rational lymphadenectomy procedure based on this evidence. During three-field dissection, the nodes along the recurrent nerves from the neck to the mediastinum are more meticulously resected than during any other procedure of radical lymphadenectomy. A consensus is obtained that complete resection of the recurrent nerve nodes improves the survival rates of patients with cancer in any location of the thoracic esophagus, and that resection of the supraclavicular or internal jugular nodes improves the survival of patients with cancer in the upper thoracic esophagus. There is, however, a controversy over whether or not resection of the supraclavicular or internal jugular nodes improves the survival of patients with cancer in the middle or lower thoracic esophagus. Moreover, there are many controversies over

the indication of three-field dissection regarding metastasis-positivity in the lymph nodes, the numbers of the metastasis-positive nodes, the stage, surgical risks and other aspects.

Three-field dissection does not always increase the mortality rate, while it increases the morbidity rates in particular complications such as recurrent nerve paralysis.

As cited by Lerut et al.¹¹⁾ there is a need for large randomized prospective studies to give conclusive evidence of the benefits of three-field dissection. Such studies are even more needed in view of the upcoming trend to treat esophageal carcinoma by minimally invasive surgery. Finally, the results from three-field dissection have to be compared with those obtained from combined chemotherapy and chemoradiotherapy followed by surgery.

References

1. Kinoshita I, Ohashi I, Nakagawa K, Kajitani T, Kaneda K, Tsuya A. Lymph node metastasis in esophageal cancer: with special reference to the upper mediastinum and measures for its treatment. *Jpn J Gastroenterol Surg* 1976; **9**: 424–30. (in Japanese)
2. Sannohe Y, Hiratsuka R, Doki K. Lymph node metastasis in cancer of the thoracic esophagus. *Am J Surg* 1981; **141**: 216–8.
3. Isono K, Sato H, Nakayama K. Results of a nationwide study on the three-field lymph node dissection of esophageal cancer. *Oncology* 1991; **48**: 411–20.
4. Isono K, Ochiai T, Okuyama K, Onoda S. The treatment of lymph node metastasis from esophageal cancer by extensive lymphadenectomy. *Jpn J Surg* 1990; **20**: 151–7.
5. Kato H, Tachimori Y, Watanabe H, et al. Lymph node metastasis in thoracic esophageal carcinoma. *J Surg Oncol* 1991; **48**: 106–11.
6. Akiyama H, Tsurumaru M, Udagawa H, Kajiyama Y. Radical lymph node dissection for cancer of the thoracic esophagus. *Ann Surg* 1994; **220**: 364–73.
7. Nishimaki T, Tanaka O, Suzuki T, Aizawa K, Hatakeyama K, Muto T. Clinical implications of cervical lymph node metastasis patterns in thoracic esophageal cancer. *Ann Surg* 1994; **220**: 775–81.
8. Baba M, Aikou T, Yoshinaka H, et al. Long-term results of subtotal esophagectomy with three-field lymphadenectomy for carcinoma of the thoracic esophagus. *Ann Surg* 1994; **219**: 310–6.
9. Fujita H, Kakegawa T, Yamana H, et al. Mortality and morbidity rates, postoperative course, quality of life, and prognosis after extended radical lymphadenectomy for esophageal cancer: comparison of three-field lymphadenectomy with two-field lymphadenectomy. *Ann Surg* 1995; **222**: 654–62.

10. Peracchia A, Ruol A, Bardini R, Segalin A, Castro C, Asolati M. Lymph node dissection for cancer of the thoracic esophagus: how extended should it be?—Analysis of personal data and review of the literature. *Dis Esophagus* 1992; **5**: 69–78.
11. Lerut T, Coosemans W, De Leyn P, et al. Reflections on three field lymphadenectomy in carcinoma of the esophagus and gastroesophageal junction. *Hepatogastroenterology* 1999; **46**: 717–25.
12. Altorki N, Kent M, Ferrara C, Port J. Three-field lymph node dissection for squamous cell and adenocarcinoma of the esophagus. *Ann Surg* 2002; **236**: 177–83.
13. Bumm R, Wong J. More or less surgery for esophageal cancer: extent of lymphadenectomy for squamous cell esophageal carcinoma—How much is necessary? *Dis Esophagus* 1994; **7**: 151–5.
14. Fumagalli U, Panel of Experts. Resective surgery for cancer of the thoracic esophagus: results of a Consensus Conference held at the 6th World Congress of the International Society for Diseases of the Esophagus. *Dis Esophagus* 1996; **9** (suppl): 30–8.
15. Watanabe H, Kato H, Tachimori Y. Significance of extended systemic lymph node dissection for thoracic esophageal carcinoma in Japan. *Recent Results Cancer Res* 2000; **155**: 123–33.
16. Dresner SM, Griffin SM. Pattern of recurrence following radical esophagectomy with two-field lymphadenectomy. *Br J Surg* 2000; **87**: 1426–33.
17. Law S, Wong J. Two-field dissection is enough for esophageal cancer. *Dis Esophagus* 2001; **14**: 98–103.
18. Kato H, Watanabe H, Tachimori Y, Iizuka T. Evaluation of neck lymph node dissection for thoracic esophageal carcinoma. *Ann Thorac Surg* 1991; **51**: 931–5.
19. Sato T, Sakamoto K. Illustration and photographs of surgical esophageal anatomy specially prepared for lymph node dissection. In: Sato T, Iizuka T, eds.; *Color Atlas of Surgical Anatomy for Esophageal Cancer*. Tokyo: Springer-Verlag, 1992; pp 25–90.
20. Japanese Society for Esophageal Diseases. Clinico-pathological aspects. In: *Guidelines for Clinical and Pathologic Studies on Carcinoma of the Esophagus*. 9th ed. Tokyo: Kanehara & Co., Ltd., 1999; pp 1–34.
21. Kakegawa T, Fujita H, Yamana H. Esophageal cancer: lymphadenectomy based on the lymph node compartment classification. *Digest Surg* 1993; **10**: 148–54.
22. Fujita H, Kakegawa T, Yamana H, Shima I. Lymph node compartments as guidelines for lymphadenectomy for esophageal carcinoma. *Dis Esophagus* 1994; **7**: 169–78.
23. Kakegawa T, Fujita H, Yamana H. The Japanese and international stage classification of esophageal carcinoma. *Surg Ther* 1992; **67**: 383–9. (in Japanese)
24. Fujita H, Kakegawa T, Yamana H, et al. Lymph node metastasis and recurrence in patients with a carcinoma of the thoracic esophagus who underwent three-field dissection. *World J Surg* 1994; **18**: 266–72.
25. Ando N, Ozawa S, Kitagawa Y, Shinozawa Y, Kitajima M. Improvement in the results of surgical treatment of advanced squamous esophageal carcinoma during 15 consecutive years. *Ann Surg* 2000; **232**: 225–32.
26. Kakegawa T. Study on rational surgery for thoracic esophageal cancer based on the esophageal lymphatic drainage. In: *Annual Report of the Cancer Research Ministry of Health and Welfare 1990*. Tokyo: National Cancer Center, 1991; pp 285–9. (in Japanese)
27. Iizuka T. Report of the 4th Meeting of ISDE TNM Reserch Committee. Kyoto, 1992.
28. Fujita H, Kakegawa T, Yamana H, Hoelscher AH, Bollschweiler E, Siewert JR. The results of en bloc esophagectomy compared with three-field and two-field dissection. In: Nabeya K, Hanaoka T, Nogami H, eds. *Recent advances in diseases of the esophagus*. Tokyo: Springer-Verlag, 1993; pp 703–8.
29. Tsurumaru M, Kajiyama Y, Udagawa H, Akiyama H. Outcomes of extended lymph node dissection for squamous cell carcinoma of the thoracic esophagus. *Ann Thorac Cardiovasc Surg* 2001; **7**: 325–9.
30. Tabira Y, Okuma T, Kondo K, Kitamura N. Indications for three-field dissection followed by esophagectomy for advanced carcinoma of the thoracic esophagus. *J Thorac Cardiovasc Surg* 1999; **117**: 239–45.
31. Shiozaki H, Yano M, Tsujinaka T, et al. Lymph node metastasis along the recurrent nerve chain is an indication for cervical lymph node dissection in thoracic esophageal cancer. *Dis Esophagus* 2001; **14**: 191–6.
32. International Union Against Cancer. Esophagus (ICD-O C15). In: Sobin LH, Wittekind Ch eds.; *TNM Classification of Malignant Tumours*. New York: Wiley-Liss, 2002; pp 60–4.
33. Udagawa H, Akiyama H. Surgical treatment of esophageal cancer: Tokyo experience of the three-field technique. *Dis Esophagus* 2001; **14**: 110–4.
34. Baba M, Aikou T, Natsugoe S, et al. Quality of life following esophagectomy with three-field lymphadenectomy for carcinoma, focusing on its relationship to vocal cord palsy. *Dis Esophagus* 1998; **11**: 28–34.
35. Japanese Society for Esophageal Diseases. Surgical treatment. In: *Guidelines for the Management of Esophageal Cancer 2002*. Tokyo: JSED, 2002; pp 8-15. (in Japanese)
36. Allum WH, Griffin SM, Watson A, Colin-Jones D. Guidelines for the management of oesophageal and gastric cancer. *Gut* 2002; **50** (suppl): 1–23.