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Radical Lymph Node Dissection for Cancer of the Thoracic Esophagus

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Objective
The authors documented the localization and frequency of lymphatic spread in squamous cell carcinoma of the thoracic esophagus and evaluated the influence of radical systematic lymph node dissection on patient survival.

Summary Background Data
From accumulated surgical experience, it was suggested that some of the patients with lymph nodal involvement from cancer could be cured by its clearance. However, it is only recently that cancer of the esophagus has been evaluated in terms of analyzing lymphatic spread and results of lymphadenectomy.

Methods
Among 1298 patients admitted to the Toranomon Hospital between 1973 and 1993, 913 (70.3%) had resections, including curative and palliative procedures. For this study, 717 patients with TNM RO (resection with no residual tumor at operation in TNM classification) were analyzed. Survival was compared between groups of patients with less extensive thoracoabdominal (two-field) dissections and extensive collothoracoabdominal (three-field) dissections.

Results
Comparative study revealed that 5-year survival rate for TNM RO patients after three-field dissection (55.0%) was significantly better (log rank test, $p = 0.0013$) than the rate after two-field dissection (38.3%). The results were particularly significant in subgroups with stage III and IV (because of nodal factor). Overall 5-year survival rate after all resections was 42.4%.

Conclusions
The role of radical lymph node dissection in cancer of the thoracic esophagus was evaluated. Long-term survival was compared between two groups with two-and three-field dissection. It was concluded that survival rate was significantly better in patients with extensive three-field dissection.

The aim of this study was to analyze the effect of prophylactic radical systematic lymph node dissection on the survival of patients with squamous cell carcinoma of the thoracic esophagus. The deta are based on accurate documentation of tumor spread with histopathologic study of depth of tumor and the status of each dissected node.

Our previous routine procedure was to dissect only the mediastinal and abdominal nodes. During this period, we noted that some cases with tumor recurrence in the cervical

Table 1. ANALYSIS OF SURGICAL TREATMENT FOR CANCER OF THE ESOPHAGUS

Treatment	No. of Patients	Percent
No surgical intervention	146	11.2
Exploration only	36	2.8
Indwelling tube	27	2.1
Bypass or feeding stoma	176	13.6
Resection	913	70.3
Total	1298	100

nodes could be cured by resection of those nodes and radiotherapy. This observation suggested a need for a complete revision of conventional belief that cervical nodal metastases meant distant spread and fatal outcome.

Subsequently, nodal dissection of the neck was added to our thoracoabdominal (two-field) or less extensive dissection, and our routine procedure became a collothoracoabdominal (three-field) dissection. The latter is an extensive nodal dissection with combined adjuvant chemotherapy, as necessary.

Lymphatic spread or recurrence is not a single fatal factor, but one of a number of important causes of death in cancer of the esophagus. Our aim was to demonstrate that there still is an opportunity left for surgeons to improve survival by anatomically well-designed and meticulous nodal dissection. This study compared the results between two different surgical protocols to evaluate in which conditions or stages extensive radical nodal dissection influences survival.

METHODS

Between January 1973 and June 1993, 1298 patients with primary squamous cell carcinoma of the thoracic esophagus were admitted to the Department of Surgery of Toranomon Hospital. Among 1298 patients, 913 had resections, including both curative and palliative procedures, with a resection rate of 70.3%. Treatment details are shown in Table 1.

For this study, 717 patients who underwent curative resection with systematic lymph node dissection with no macroscopic residual tumor at operation (RO cases in TNM classification) were analyzed.

To compare survival, 717 patients with curative resection were divided into two groups according to the extent of nodal dissection. Two- and three-field dissections were performed in 393 and 324 patients, respectively. Two-field—less extensive dissection—was performed between 1973 and 1984.[1] Three-field—extensive dissection[2,3]—has been carried out as a routine procedure since 1984. Adjuvant chemotherapy with cisplatin (CDDP; 100 mg/m^2) and 5-fluorouracil (1000 mg/m^2) on days 1 through 4 also was administered to patients with histopathologically positive lymph node involvement in the cervical and or superior mediastinal regions.[4] Operations were performed according to the methods reported previously by the authors via a right thoracotomy, upper median laparotomy, and cervical approach. The lymph nodes dissected are shown in Figure 1.

Estimation of survival was calculated by the Kaplan-Meier method. The significance of differences in survival was evaluated by the log rank test and the generalized Wilcoxon test.

RESULTS

Indications for Radical Nodal Dissection

Because nodal dissection may be associated with morbidity, it should only be undertaken if morbidity can be

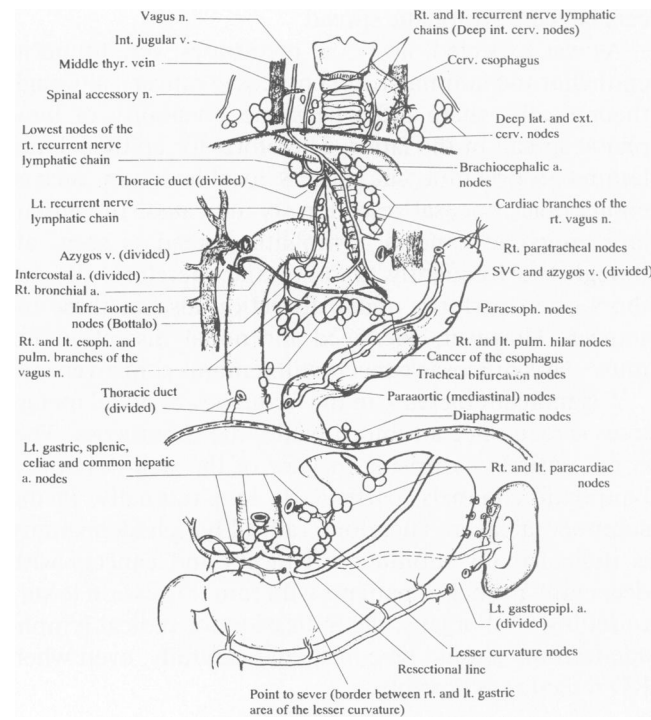

Figure 1. Extent of esophageal and gastric resection and systematic radical lymph node dissection. Extent of extensive three-field dissection is shown. In two-field dissection, no cervical dissection is carned out.

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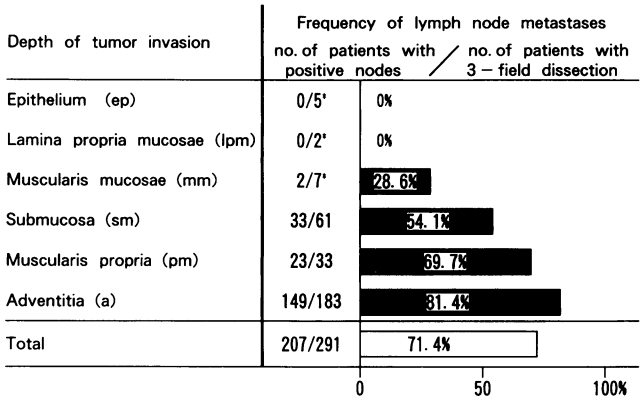


Figure 2. Frequency of lymph node metastases according to the depth of tumor invasion. *Three-field dissection was carried out for only a small number of patients with mucosal cancer.

minimized and there is a potential to cure. Therefore, it is indispensable to have high-standard preoperative diagnosis in regard to tumor spread with modern imaging techniques and accurate evaluation of patients' general condition and potential risk factors.

Depth of Tumor Invasion and Surgical Strategy

In the early period of the study, extensive three-field dissection was performed for invasive cancers and also for mucosal cancers to document lymphatic spread for all depths of tumor invasion (Fig. 2). This was undertaken to avoid the preconceived idea that mucosal cancers have no lymphatic spread.

As was expected, no nodal metastases were found in epithelial and lamina propria mucosae cancers, although theoretically, there must be some possibility of lymphatic spread in the latter. Therefore, for epithelial and lamina propria mucosae cancers, local resection, such as endoscopic mucosal resection, is indicated. In muscularis mucosae cancers, lymphatic spread is seen, although less frequently (28.6%), and therefore, the authors often perform nodal dissection also in these instances. However, the need for nodal dissection for muscularis mucosae cancers still remains controversial.

A significant increase in the frequency of nodal metastases is seen once a tumor invades the submucosa. This is not entirely surprising in view of the well-developed lymphatic channels, particularly longitudinally, in the submucosal layer. Therefore, radical lymphadenectomy is indicated for submucosa cancers and cancers with deeper invasion. For patients with tumor invasion to surrounding vital organs, the indication for radical lymphadenectomy should be considered carefully, even when RO resection is possible.

Curable Number of Metastatic Nodes

The number of lymph nodes involved has been said to be one of the best indicators for predicting prognosis.[5] Even after radical lymphadenectomy, there may be a critical number of metastasized lymph nodes, which can divide the prognosis into a favorable and unfavorable one.

The critical number of metastatic nodes dividing the prognosis most significantly, even by radical three-field lymph node dissection, was between 1 and 7 and 8 or more (Fig. 3; $p < 0.0001$). The latter implies upper limit of involved nodes influenced by radical resection. When positive nodes were found in more than this number, particularly by gross palpation or preoperative imaging techniques, the predictive outcome was unfavorable. In such cases, it is wise not to attempt systematic nodal dissection because they are too advanced or may be too biologically malignant[2] for radical nodal dissection.

Operative Morbidity and Mortality

Postoperatively, pulmonary complications were seen most frequently (31.1%). The 30-day operative mortality rate after resection with systematic lymph node dissection was 2.2%, and the hospital death rate (including all deaths within 30 days after operation and deaths due to early tumor recurrence) was 5.2%. Lymph node dissection is modified or avoided in the presence of pre-existing cardiopulmonary problems, significant extrathoracic disease, or severe right pleural adhesions. Cardiac and pulmonary branches of the vagus nerves,[2,6] right bronchial artery (if possible, left side also),[2] and vascular sheath of the trachea are preserved to minimize postoperative complications.

Frequency of Lymph Node Metastases

General Distribution of Nodal Metastases

For accurate documentation, only the series of collothoracoabdominal dissections were used for analysis of

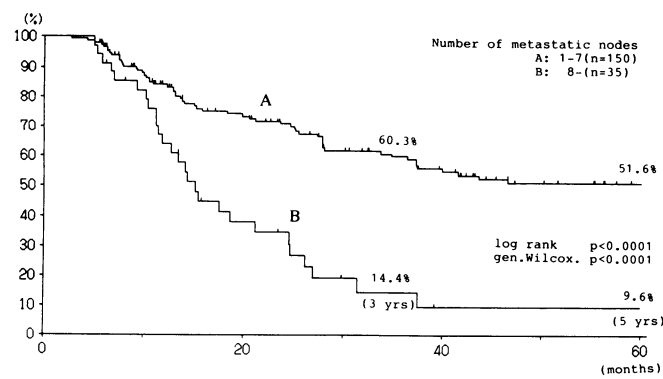


Figure 3. Number of positive nodes most significantly dividing the outcome into favorable and unfavorable ones (three-field dissection).

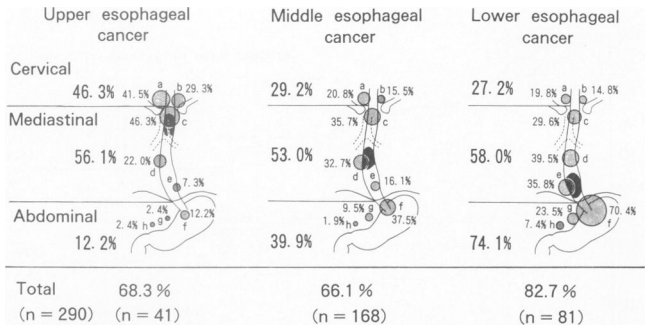


Figure 4. Frequency of lymph node metastases according to location of tumor (three-field dissection, n = 290). (a),(b) Right and left cervical nodes; (c) superior mediastinal nodes; (d) middle mediastinal nodes; (e) lower mediastinal nodes; (f) superior gastric nodes; (g) celiac trunk nodes; (h) common hepatic artery nodes.

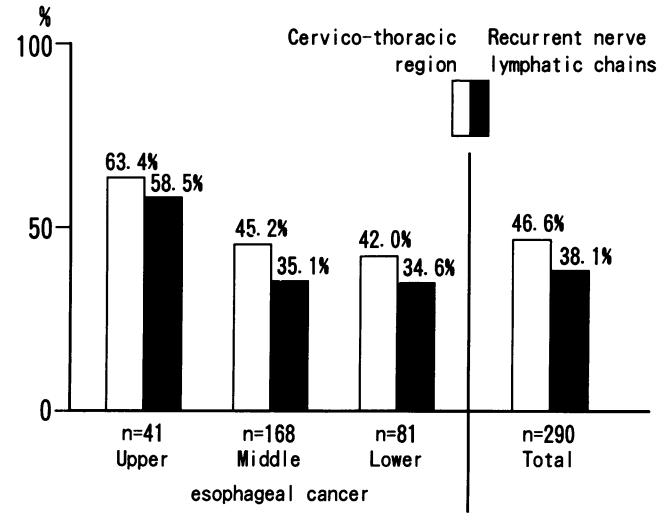


Figure 5. Frequency of lymph node metastases to the cervicothoracic region and specifically, recurrent nerve lymphatic chains (three-field dissection).

frequency of nodal metastases per number of cases on the basis of microscopic examination.

Of 290 patients, 206 (71.0%) had lymph node metastases. The frequency of nodal metastases was studied according to location of tumor and each of three fields—cervical, mediastinal, and abdominal (Fig. 4). The frequency of positive lymph nodes according to the location of the primary tumor and the anatomical region of lymph node groups is shown in Figure 4.

The results shown in Figure 4 reveal a good correlation between adjacent regional lymph node involvement and location of tumor. However, the involvement of distal regional nodes, regardless of location of tumor, was unpredictable. Therefore, for prophylactic purposes, the clearance of nodes in all three fields is logical wherever the primary cancer is located in the mediastinum.

The Cardinal Area for Dissection

Among the various sites for possible nodal metastases, the cervicothoracic region—particularly the recurrent laryngeal nerve lymphatic chains[2,3,7]—is of utmost importance because of high frequency of tumor spread and frequent site of recurrence, and because of the surgical difficulties of clearance caused by anatomic complexity in relation to important organs, such as the trachea and recurrent laryngeal nerves, which are extremely vulnerable.

Figure 5 shows frequency of metastases in the cervical and superior mediastinal region, specifically with regard to the recurrent nerve lymphatic chains. These lymphatic chains cannot be divided artificially into two groups, such as cervical and thoracic portions, but should be understood as one entity.[2] Not surprizingly, the frequency of involvement was highest in patients with cancer of the upper thoracic esophagus. However, the frequency still remained considerably high and showed approximately the similar rates in both middle and lower thoracic esophageal cancers. This emphasizes the importance of nodal dissection of this area for the upper thoracic esophageal cancers and cancers of the lower levels of thoracic esophagus.

Differences in Survival Between Extensive Three-Field and Less Extensive Two-Field Dissection According to Nodal Status

In both groups—cancer-negative (Fig. 6) and cancer-positive (Fig. 7)—the survival of patients after extensive three-field dissection was significantly better than those after less extensive two-field dissection. The differences may be because in both groups with negative and positive nodes, occult cancer-positive nodes in the cervical region and other areas, which might have been present and omitted from dissection and analysis in the group

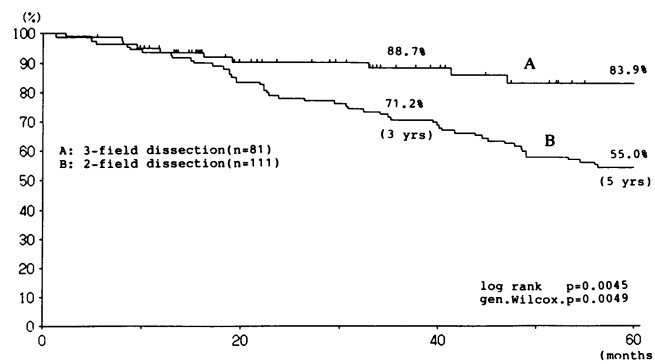


Figure 6. Comparison of survival in patients with negative nodes between two- and three-field dissections.

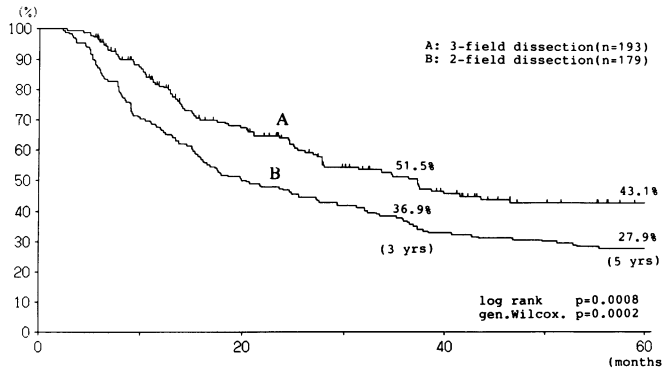
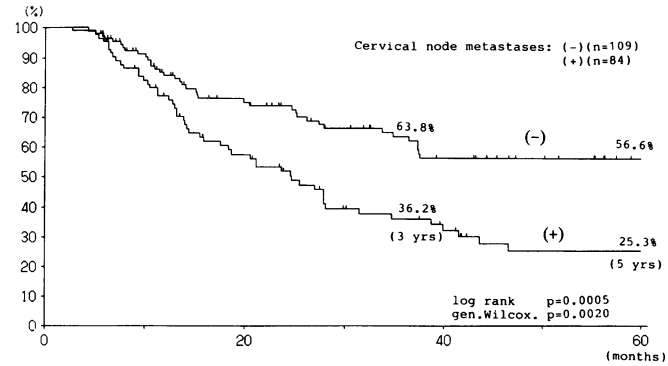


Figure 7. Comparison of survival in patients with positive nodes between two- and three-field dissections.



Figue 8. Metastases to the cervical nodes and survival after three-field dissection.

with less extensive dissections, were removed by extensive dissection.

Prognostic Differences Between the Two Dissection Groups According to the Location of Cancer

Comparative of survival curves between extensive three-field and less extensive two-field dissections, according to location of cancer, are shown in Table 2. In the upper thoracic esophageal cancer, the difference was significant only by gen. Wilcox. Test ($p = 0.0319$). A 5-year survival rate (63.2%) was achieved by extensive dissection for cancers of this region.

In comparative studies, the results after extensive dissection were significantly more favorable in cancer of the middle thoracic esophagus. The result of extensive dissection was better in cancer of the lower esophagus, but was not significant. From the results of the frequency of nodal metastases in the cervicothoracic and recurrent nerve lymphatic chains shown in Figure 5, and from the fact that in extensive dissection, a meticulous nodal dissection of the same regions was undertaken, it is not surprising that the prognosis was favorable in the upper and middle esophageal cancer.

Are the Cervical and Celiac Trunk Nodes "Distant"?

To clarify the implication of cancer spread to the cervical and celiac trunk lymph nodes in regard to the curability, the results after extensive three-field dissection between groups with and without nodal involvement to those nodes was compared.

Survival curves between groups with negative and positive cervical nodes are shown in Figure 8. To make the comparative analysis valid, only patients with negative cervical nodes, but with positive other nodes, were entered as members of the negative cervical node group. The difference in survivals was significant. It is of note that 25.3% of the patients with positive cervical nodes survived more than 5 years.

A comparison between the patient groups with nega-

Table 2. SURVIVAL DEPENDING ON LOCATION OF TUMOR AND COMPARISON OF 2- AND 3-FIELD LYMPH NODE DISSECTIONS

Location of Tumor	Mode of Dissection	No. of Patients	Survival Rates		p Value	
			3-yr	5-yr	Log Rank Test	General Wilcoxon Test
Upper esophagus	3-field	36	63.2 ± 9.2%	63.2 ± 9.2%	0.0584	0.0319
	2-field	24	33.3 ± 9.6%	29.2 ± 9.3%		
Middle esophagus	3-field	161	65.2 ± 4.2%	56.5 ± 4.7%	0.0054	0.0116
	2-field	169	54.4 ± 3.8%	39.1 ± 3.8%		
Lower esophagus	3-field	74	56.6 ± 6.3%	48.0 ± 6.6%	0.1977	0.0891
	2-field	84	45.2 ± 5.4%	39.3 ± 5.3%		

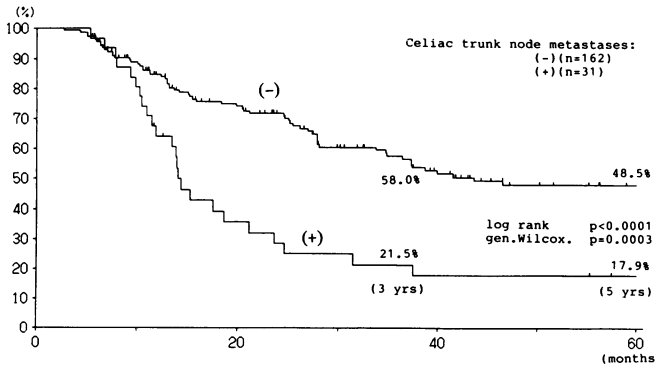


Figure 9. Metastases to the celiac trunk nodes and survival after three-field dissection.

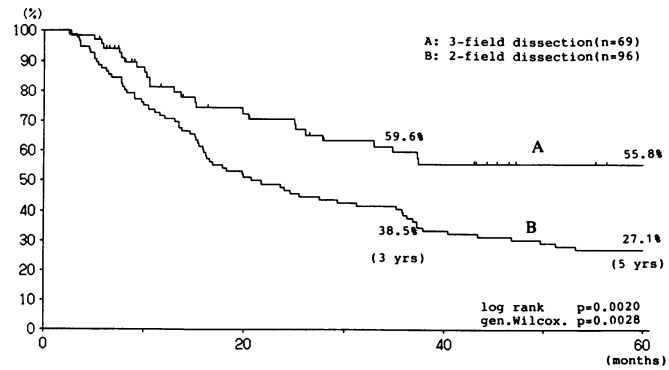


Figure 10. Comparison of survival curves after two- and three-field dissections (pTNM stage III).

tive and positive celiac trunk nodes is shown in Figure 9. As in the study of cervical nodes, patients with negative celiac trunk nodes, but with positive other nodes, were regarded as members of the negative celiac node group. The difference in survival between the two was significant, and it was encouraging that the 5-year survival rate in the group with positive celiac trunk nodes was 17.9%. It is advisable to remove celiac trunk nodes and the adjacent further nodes, such as the common hepatic and the splenic artery nodes, as a routine, because a 5-year survival rate of 21.7% was obtained in patients with metastatic cancer in any of the celiac trunk, splenic, and common hepatic artery nodes.

Comparison Between the Two Dissection Groups According to pTNM Staging

Five-year survival rates after two-and three-field dissection according to pTNM classification are shown in Table 3. The number of patients with stage IV-pN (stage IV caused by histopathologically proven nodal metastases, but not other distant or organ metastases) in extensive three-field dissection group is larger than that in the less extensive two-field dissection group because of down-staging (stage migration). For example, positive cervical nodes in stage IV-pN patients in the two-field dissection group were only those found by preoperative examination or by "pick-up" of metastases-containing suspicious nodes at operation. Consequently, the results are somewhat deviated statistically. In stage III and IV-pN, the survival improved significantly after extensive dissection (Figs. 10 and 11). There were no 5-year survivors after various palliative procedures for patients with more advanced cancer spread.

Overall Survival

The 5-year survival rates for patients with all depth of cancer invasion after extensive three-field and the less extensive two-field dissections were 55.0% and 38.3%, respectively. However, this series of curative resections with radical nodal dissection include 4.8% of patients

Table 3. FIVE YEAR SURVIVAL RATES AFTER 2- AND 3-FIELD DISSECTION ACCORDING TO pTNM STAGING

	Less Extensive 2-Field Dissection		Extensive 3-Field Dissection	
pTNM Stage	n	5-Yr Survival Rates	n	5-Yr Survival Rates
0	4	100%	4	75.0%†
I	26	69.2 ± 9.1%	35	94.1 ± 5.7%
II A	71	47.9 ± 5.9%	39	82.5 ± 6.6%
II B	43	46.5 ± 7.6%	27	57.3 ± 14.1%
III	96	27.1 ± 4.5%	69	55.8 ± 6.6%
IV-pN*	36	11.1 ± 5.2%	99	28.0 ± 5.4%

* Stage IV due to pN factor.
† One patient died of nonmalignant disease.

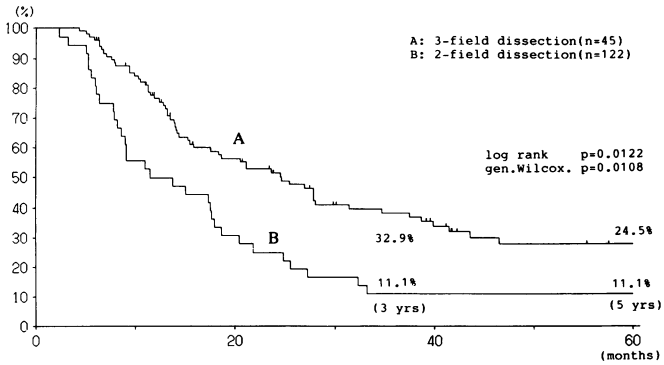


Figure 11. Comparison of survival curves for pTNM stage IV-pN patients after two- and three-field dissections.

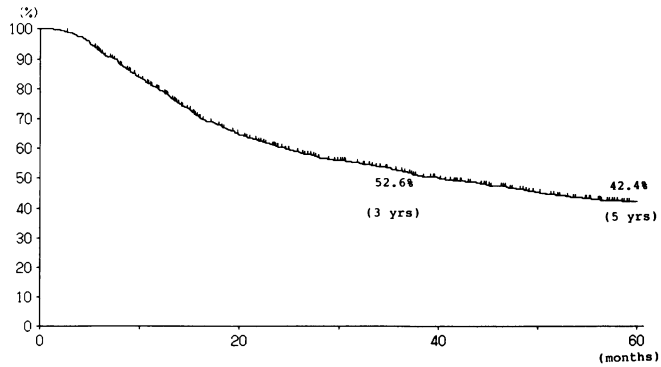


Figure 13. Overall survival after all resections.

with mucosal cancer. Because these cases rarely have nodal metastases, it is fair to exclude patients with mucosal cancers from the series to study the effect of nodal dissection. With the exclusion of mucosal cancers, the 5-year survival rate after less extensive and extensive dissections were 37.1% and 52.2%, respectively (Fig. 12). The results are significantly better in group that underwent radical lymphadenectomy.

Survival curves for all resections, including those patients undergoing curative and palliative resection and esophagectomy without thoracotomy but excluding patients with endoscopic local mucosal resections and cases with operative and hospital deaths, is shown in Figure 13. The 3-year and 5-year survival rates were 52.6% and 42.4%, respectively.

DISCUSSION

Historical Delay in the Development in Nodal Clearance in Esophageal Cancer

As early as 1894, Halsted[8] reported the first results of radical mastectomy for breast cancer. This included meticulous dissection of the axillary lymph nodes and in some cases, also the supraclavicular nodes. The same author reported that 2 of 45 patients who had removal of supraclavicular node metastases were long-term survivors. Early in this century, Moynihan[9] stated that an accurate knowledge of the lymphatic system of the stomach, as of other organs, is essential if the operative treatment of malignant disease therein occurring is to be attended with any degree of success.

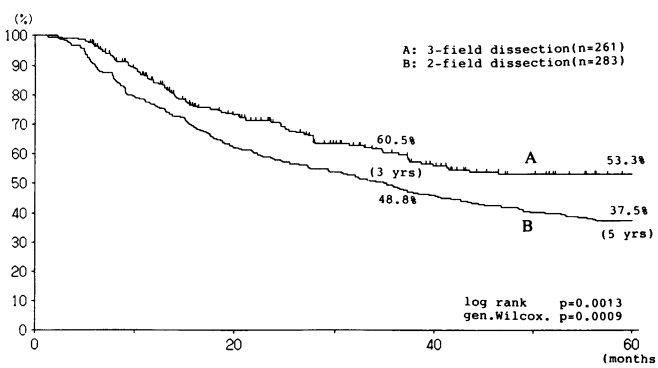


Figure 12. Comparison of survival after two- and three-field dissections for patients excluding those with mucosal cancer.

From such accumulated surgical experience, it was suggested that some of the patients with lymph nodal involvement from cancer could be cured by its clearance. Subsequently, in gastrointestinal malignancy, one of the major advances in modern surgery has been the recognition of lymphadenectomy as an important procedure to improve survival. Although many years ago, Nakayama[10] and Logan[11] advocated the importance of celiac trunk and mediastinal node dissection, respectively, it is only recently that cancer of the esophagus has been evaluated in terms of analyzing lymphatic tumor spread and results of lymphadenectomy.[1-3, 12-14] What was the reason many authors avoided or limited the lymphatic clearance for cancer of the esophagus? Delay in the development in lymph node dissection for cancer of the esophagus may have been caused by the magnitude of surgery and risk of significant postoperative morbidity.[15] Throughout a systematic nodal dissection, meticulous techniques is required, e.g., in dissecting recurrent laryngeal nerve lymphatic chains, particularly on the left side, and in dissecting infra-aortic arch nodes. This study highlights the results that can be obtained with acceptable operative morbidity and mortality.

Despite the advances in lymph nodes extirpation during the last few decades, there currently is a mood of scepticism[16] as to whether lymph node dissection really contributes to an improvement of survival. Our aim was to answer such controversy.

Uniformity in the Extent of Nodal Dissection

The terms standard esophagectomy or esophagectomy with lymph node dissection are poorly defined. The ex-

tent of nodal dissection for cancer of the esophagus in this study was designed according to the anatomy of lymphatic draining system of the esophagus[2,17,18] and to past experience with regard to mode of recurrence. Some authors remove only neighboring, enlarged, visible, or hard lymph nodes simply by palpation, but use the term radical lymphadenectomy. In such cases, many nodes with possible microscopic or occult metastases may be neglected and left behind. In fact, microfoci of metastases frequently are found in dissected nodes that look normal. Therefore, except in the case of suspicious distant lymph nodes, it does not make sense intraoperatively to send a locoregional node to pathology for frozen section because operative strategy should not be influenced by the result. The philosophy of systematic lymph node dissection is based on this concept and should be considered prophylactic surgery.

Which Subgroup of Patients Will Benefit from Systematic Nodal Dissection?

The opinion that only some subgroups of patients will benefit from systematic nodal dissection[12,19] is correct. For epithelial and lamina propria mucosae cancers, endoscopic mucosal resection is indicated, provided that the lesions are of suitable size and numbers. For large and multiple epithelial and lamina propria mucosae cancers, particularly for those with suspected field carcinogenesis, esophagectomy without thoracotomy is indicated. From our study, it was concluded that nodal dissection is needed for tumors with a depth between submucosa and adventitia. For tumors extending beyond adventitia, the feasibility of local control is a prerequisite before nodal dissection. However, resection of the cancer-involved aorta, except for palliation to avoid massive hemorrhage, rarely is indicated because of possible early recurrence of cancer. The need for nodal dissections for lesions of the muscularis mucosae is controversial. Systematic nodal dissection is effective in patients with only limited cancer stages, namely stages III and IV-pN.

Radical nodal dissection may not be effective and may be harmful for highly malignant tumors. Malignancy or type-oriented therapy recently has been reviewed.[2,20] Advances in the molecular biologic approach to this issue recently have been made, and it is possible, in the near future, that we will be able to use the results of these studies to select patients for radical lymph node dissection and other therapeutic regimens.

Criticism of Lack of Randomized Prospective Study

The comparison of survival time between (collo)thoracoabdominal radical lymph node dissection and transhiatal approaches often is discussed.[21] There is a common criticism regarding the lack of randomized prospective studies directed toward this problem. However, it seems to the authors that the debate on the basis of different oncologic documentation, particularly, with regard to the transhiatal approach,[22] is in vain. It is absolutely impossible to make a comparative study between transhiatal approach and nodal dissection on the same ground of tumor stages. Strictly speaking, the situation is the same, even between groups that undergo two- and three-field nodal dissections.

Esophagectomy without thoracotomy or transhiatal esophagectomy is one of authors favorite surgical approaches in selected cases.[23] The authors select esophagectomy without thoracotomy on oncologic grounds, i.e., for cases with wide or multiple epithelial and lamina propria mucosae cancers or with field carcinogenesis, and because of its advantages of minimizing surgical stress. In our experience of esophagectomy without thoracotomy, there were no incidences of recurrent nerve paralysis or thoracic duct or pleural damage, resulting in a very low complication rate. Therefore, esophagectomy without thoracotomy often is used by the author for patients with severe pleural adhesion, poor pulmonary or cardiac function, and other high-risk clinical conditions, and for palliative purposes.

Our criteria of selecting esophagectomy without thoracotomy is based on established indications and does not provide sufficient common material appropriate for significant evaluation or comparison of the results with other surgical approaches.

This study primarily involved two groups of patients undergoing different degrees of radical lymph node dissection, over consecutive periods; each patient's progress was observed by the same author and surgical team, not on the basis of historical controls. Although accepting the potential problems of down-staging in the group of patients undergoing more extensive nodal dissections, it has allowed a meaningful comparative study of patients, excluding those with mucosal cancer alone (Fig. 12). Significantly better results were identified in the three-field dissection with comparable long-term results to those reported and reviewed by Peracchia[18] and Inokuchi.[19] Because this strategy is based on our own philosophy and patients' individual clinical conditions, a randomized prospective trial is impossible and seems to be unethical to us. It should be emphasized however, that the selection of surgical approach must be based on accurate preoperative evaluation in terms of risk of operation and tumor spread, with the aid of high-quality modern imaging techniques. Thorough analysis of resected specimens and postoperative course are indispensable for oncologic evaluation and for selection of patients who might benefit from nodal dissection or adjuvant radiochemotherapy.

References

1. Akiyama H, Tsurumaru M, Kawamura T, Ono Y. Principles of surgical treatment for carcinoma of the esophagus. Ann Surg 1981; 194:438–446.
2. Akiyama H. Surgery for Cancer of the Esophagus. Baltimore: Williams & Wilkins, 1990.
3. Tsurumaru M, Udagawa H, Ono Y, et al. Surgical treatment of intrathoracic esophageal carcinoma. *In* Nabeya K, Hanaoka T, Nogami H, eds. Recent Advances in Diseases of the Esophagus. Berlin: Springer-Verlag, 1993, pp 697–702.
4. Udagawa H, Tsurumaru M, Ono Y, et al. Evaluation of adjuvant therapy for esophagectomy with collo-thoraco-abdominal lymph node dissection. *In* Nabeya K, Hanaoka T, Nogami H, eds. Recent Advances in Diseases of the Esophagus. Berlin: Springer-Verlag, 1993, pp 697–702.
5. Skinner DB, Belsey RHR. Management of Esophageal Disease. Philadelphia: WB Saunders, 1988, pp 740–743.
6. Kajiyama Y, Tsurumaru M, Ono Y, Udagawa H, et al. Clinical effect of the preservation of cardiac branch of the right vagal nerve on the post-operative condition after the resection of esophageal cancer with 3-regional lymph node dissection. Japan J Gastroenterol Surg 1992; 25:2446.
7. Akiyama H. Cardinals in the regional lymph node dessection in surgery of thoracic esophageal cancer. *In* Siewert JR, Hölscher AH, eds. Diseases of the Esophagus. Berlin: Springer-Verlag, 1987, pp 416–420.
8. Halsted WS. The results of operations for the cure of cancer of the breast performed at Johns Hopkins Hospital from June 1889 to January, 1984. Johns Hopkins Med Bull 1984; 4:497–555.
9. Moynihan B. Abdominal Operations. Vol. I. Philadelphia and London: WB Saunders. 1916, pp 285–317.
10. Nakayama K, Hirota K. Experience of about 3000 cases with cancer of the esophagus and the cardia. Austr N Z J Surg 1962; 31: 222–230.
11. Logan A. The surgical treatment of carcinoma of the esophagus and cardia. J Thorac Cardiovasc Surg 1963; 46:150–161.
12. Siewert JR, Roder JD. Lymphadenectomy in esophageal cancer surgery. Dis Esoph 1992; 2:91–97.
13. Skinner DB. En bloc resection for neoplasms of the esophagus and cardia. J Thorac Cardiovasc Surg 1983; 85:59–71.
14. DeMeester TR, Zaninotto G, Johansson KE. Selective therapeutic approach to cancer of the lower esophagus and cardia. J Thorac Cardiovasc Surg 1988; 95:42–52.
15. Ong GB, Lam KH, Wong J, Lim TK. Factors influencing morbidity and mortality in esophageal carcinoma. J Thorac Cardiovasc Surg 1978; 76:745–754.
16. Veronesi U, Valagussaa P. Inefficacy of internal mammary nodes dissection in breast cancer surgery. Cancer 1981; 47:170–175.
17. Haagensen CD, Feind CR, Herter FP, et al. The lymphatics in cancer. Philadelphia: WB Saunders Co, 1972.
18. Sato T, Sakamoto K. Illustrations 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 and Berlin: Springer-Verlag, 1992, pp 25–90.
19. Peracchia A, Ruol A, Bardini R, et al. Lymph node dissection for cancer of the thoracic esophagus: how extended should it be? Analysis of personal data and review of the literature. Dis Esoph 1992; 5:69–78.
20. Inokuchi K. Milestones along the road to improvement of results in the treatment of squamous cell carcinoma of the esophagus. *In* Sato T, Iizuka T, eds. Color Atlas of Surgical Anatomy for Esophageal Cancer. Tokyo and Berlin: Springer-Verlag, 1992, pp 1–8.
21. DeMeester TR, Barlow AP. Surgery and current management for cancer of the esophagus and cardia: part I. Current Probl Surg 1988; 25:512–514.
22. Orringer MB. Transhiatal esophagectomy without thoracotomy for carcinoma of the thoracic esophagus. Ann Surg 1984; 200:282–288.
23. Akiyama H. Esophagectomy without thoracotomy. *In* Nyhus LM, series ed. Surgery Annual, Vol. 13 New York: Appleton-Century-Crofts, 1981, pp 109–121.

Discussion

DR. TOM R. DEMEESTER (Los Angeles, California): This paper is significant for at least two reasons. First, it comes from an individual, Dr. Hiroshi Akiyama, who has dedicated his life to the study of esophageal carcinoma and it reflects his experience with the disease on a personal level over a large number of years. And I can attest to the care that he gives to lymph node mapping. I have had the opportunity to visit his hospital and watch him operate. There were two young physicians involved in numbering several little specimen bottles. As the dissection was done, the bottles were filled with lymph nodes and accurately labeled with their location. All of this took place right at the operating table and was not dependent on a pathologist down the hall to identify nodes in the specimen with no idea what was top or bottom. I can attest that the data presented to us today was derived carefully by a man who has immense experience with this disease.

The second reason this presentation is important is that it comes at a time when there is an attitude that performing a lymph adenectomy while resecting an esophageal carcinoma is unimportant in regards to patient outcome. This paper has established beyond a doubt that there is a significant group of patients that are benefitted by a traditional en bloc dissection of the esophagus, and its regional lymph nodes. These are dramatic results for this disease and strongly support the position that a lymph node dissection is an important component in the surgical therapy of these patients.

I would like to ask two questions.

First, Dr. Akiyama has pointed out that for cancers in the lower third of the esophague, there is no survival benefit in removing the lymph nodes in the neck, that is, lymph nodes located some distance away from the primary tumor. I ask whether he feels similarly about removing abdominal lymph nodes in patients with cancers arising in the upper third of the esophagus. He may not have specific data to answer this question, but I would be interested in his impression based on his years of experience.

Second, I would like to have him comment on how his observations might affect surgeons in this country who see primary adenocarcinoma of the esophagus. Does this type of cancer act similarly and do the principles applicable to squamous carcinoma also apply to adenocarcinoma of the esophagus?

DR. LUCIUS D. HILL (Seattle, Washington): I, too, was very much impressed with this paper. To achieve a 42% 5-year survival rate and only a 2.5% mortality rate is really a mark for us to shoot at.

The authors' 70% resection rate brings up a point which I think