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European Journal of Cardio-thoracic Surgery 23 (2003) 415–420

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

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Subtotal esophagectomy with extended 2-field lymph node dissection for thoracic esophageal cancer

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Received 19 August 2002; received in revised form 16 November 2002; accepted 25 November 2002

Abstract

Objective: To examine the efficacy of the Ivor Lewis esophagectomy with extended 2-field lymph node dissection for thoracic esophageal carcinoma we reviewed our experience. **Methods**: We analyzed the cases of 147 consecutive patients who underwent subtotal esophagectomy with extended 2-field lymph node dissection through Ivor Lewis approach for esophageal cancer from January 1996 through December 2000. Eighty-six patients were operated on for cancer of the midthoracic esophagus, 48 for cancer of the lower thoracic esophagus, and 13 for cancer of the aortal segment of the esophagus. No patient had received chemotherapy or radiotherapy before operation. **Results**: There were 113 men (76.9%) and 34 women. Median age was 57 years (range 51–65 years). Postsurgical pathological studies revealed squamous cell carcinoma in 139 patients (94.6%), adenocarcinoma in five (3.4%), and adenosquamous carcinoma in three (2%). Positive abdominal and/or mediastinal lymph nodes were found in 122 patients (82.9%). At mean 43 nodes (range from 32 up to 75) were studied for each patient. Even in T_1–T_2 tumors mediastinal or abdominal lymph nodes are involved in up to 80% of cases. However, in T_3–T_4 stages the frequency of lymph node involvement is significantly higher ($P < 0.05$). Postsurgical staging was as follows: stage I in three patients (2%), stage IIa in 20 (13.6%), stage IIb in 29 (19.7%), stage III in 54 (36.8%), and stage IV in 41 (27.9%). All distant metastases were lymphogenous. The operative mortality rate was 6.1%, and complications occurred in 62 patients (42.1%). The overall 5-year survive rate was 28.8% (median survival 36.1 months). The 5-year survival rate for patients in stage IIa was 59%; for those in stage IIb, 39.5%; for patients in stage III, 26.7%; and 0% for patients in stage IV. **Conclusions**: Subtotal esophagectomy with extended 2-field lymph node dissection through Ivor Lewis approach for esophageal cancer is a safe operation. Long-term survival is stage dependent. Effective multimodality treatment may be helpful for patients with advanced disease.

Keywords: Esophageal cancer; Ivor Lewis approach; Extended lymph node dissection

1. Introduction

Esophageal carcinoma is an aggressive disease with a poor prognosis. Surgical resection remains the basic method of management of this malignancy. The Ivor Lewis operation was first described in 1946 [1], and we have used it predominantly for the past 20 years. Recently, preoperative chemotherapy and radiation therapy have been used in an attempt to increase long-term survival [2–4]. However, in our clinic the primary surgery remains the preferred mode of treatment. A radical operation, which includes not only complete removal of the main tumor but also an extended dissection of the lymph nodes in the mediastinum and abdomen through laparotomy followed by a right thoracotomy has been our standard method of treatment of esophageal cancer. To establish a benchmark for surgical treatment of esophageal carcinoma prior to the widespread use of preoperative chemotherapy and radiation therapy, we reviewed our experience with the Ivor Lewis esophagectomy with extended lymph node dissection during a time when adjuvant therapy was rarely used. The objective of this study was to examine the morbidity, mortality, and efficacy of an Ivor Lewis esophagectomy with extended 2-field lymph node dissection for the treatment of cancer of the thoracic esophagus and to analyze the outcome of the patients.

2. Patients and methods

From January 1996 through December 2000, 212 patients were admitted to our clinic with esophageal malignancy. Seventeen (8%) patients were found unresectable and received palliation. One hundred and ninety-five patients underwent Ivor Lewis esophagectomy. Among them, 147

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doi:10.1016/S1010-7940(02)00801-1

patients (75.4%) underwent an Ivor Lewis esophagectomy with extended 2-field lymph node dissection, and were retrospectively reviewed. Their clinical records were reviewed for age, sex, and symptoms at diagnosis, details of the surgical procedure, pathological findings, postoperative course, and long-term survival. To characterize extent of the lymph node dissection, we use the Ide et al. classification: standard 2-field (2S), extended 2-field (2F) and 3-field resections (3F) [5]. 2S resection includes bilateral lymph node dissection in the mediastinum below carina, 2F resection includes total mediastinal lymph mode dissection up to apex of the chest. In 3F resection bilateral cervical lymph node dissection is performed. All types of resections imply abdominal D2 lymph node dissection as in gastrectomy.

Operative mortality was defined as any death during the first 30 days after operation or during the same hospitalization. All tumors were staged postsurgically by the TNM classification system (UICC, 1987) [6].

Fisher's exact two-tailed test was used to compare differences in patient characteristics [7]. Overall patient survival was estimated using the product-limit method of Kaplan and Meier, in which the initial day of treatment was the day of surgery [8]. Operative deaths and deaths that were not related to cancer were included in the survival statistics. Estimates and 95% confidence intervals (CI_{95}) are given for 3 and 5 years. The log-rank test was used to compare differences in survival curves [9]. A *P*-value of less than or equal to 0.05 was considered to be significant.

2.1. Clinical findings

There were 113 men (76.9%) and 34 women. Median age was 57 years (range 51–65 years). Dysphagia was present in 144 patients (97.8%) preoperatively. Eighty-six patients were operated on for cancer of the midthoracic esophagus, 48 for cancer of the lower thoracic esophagus, and 13 for cancer of the upper thoracic esophagus. In all 13 patients with upper thoracic esophageal cancer the tumor was located not above aortal segment of the esophagus. The diagnostic evaluation consisted of endoscopy with biopsy, contrast radiology, external sonography of abdomen and neck. Routine chest radiography, spirometry and electrocardiography were also performed. Every patient had a bronchoscopy, and computed tomography was performed in 87 patients. The malignancy was found by esophagogastroduodenoscopic surveillance in five asymptomatic patients. Before treatment in all patients the diagnosis was affirmed histologically. No patient had received chemotherapy or radiotherapy before operation.

2.2. Surgical procedure

All 147 patients underwent subtotal esophagectomy with extended 2-field lymph node dissection. In brief, all the patients underwent initial abdominal exploration through an upper midline laparotomy. The stomach was mobilized on the right gastric and right gastroepiploic arteries. The left gastric artery was divided at its origin, and all lymph nodes around the celiac trunk and its main branches were included in the resection. Lymph tissue of the portal vein, hepatic artery and splenic hilum also was removed. No pyloroplasty or other drainage procedure was done, and a Kocher maneuver was performed. The greater omentum was resected. After the abdominal stage a right posterolateral thoracotomy was performed. The esophagus was mobilized with the all paraesophageal and subcarinal lymph nodes. Also upper mediastinal, right and left paratracheal lymphatic tissue including lymph nodes of recurrent laryngeal nerve were removed. The thoracic lymph duct was resected from diaphragm to the apex of the chest. Denudation of the lesser curvature was usually performed in the pleural cavity. Combined resections were performed 28 in patients (19%) (Table 1). Lung resection was wedge excision; splenectomy and pancreas resection were done due to intraoperational trauma. No resection was macroscopically palliative (R2).

Table 1
Resected organs in 28 patients who underwent combined extended subtotal esophagectomy

Resected organ	No. of cases
Spleen	16 (57.1%)
Liver	1 (3.6%)
Tail of the pancreas	1 (3.6%)
Pericardium	11 (39.3%)
Adventitia of the aorta	2 (7.1%)
Lung	19 (67.8%)

After resection of the specimen, a hand-made, two-layer fashioned anastomosis was constructed between the stomach and the esophagus. The anastomosis was located in the apex of the chest in all the patients.

On day 6 or 7 after surgery patients underwent contrast X-ray study or endoscopy for assessment of esophagogastric anastomosis. After this the enteral feeding was begun.

3. Results

3.1. Pathohistological findings

Postsurgical pathological studies revealed squamous cell carcinoma in 139 patients (94.6%), adenocarcinoma in five (3.4%), and adenosquamous carcinoma in three patients (2%). The tumor was exophytic in 14 patients, endophytic in 29, infiltrative-ulcerous in 46 and exo-endophytic in 58 patients. In four patients (2.7%) the resected margin of the esophagus was found to have microscopic tumor involvement.

Positive lymph nodes were found in 122 patients (82.9%). At mean 43 nodes (range from 32 up to 75) were studied for each patient. The frequency of the metastatic involvement of different mediastinal lymph nodes depending on tumor localization is shown in Table 2.

Table 2
Involvement of abdominal and mediastinal lymph nodes depending on tumor localization

Lymph nodes	Tumor localization		
	Upper thoracic esophagus ($n = 13$)	Midthoracic esophagus ($n = 86$)	Lower thoracic esophagus ($n = 48$)
Upper paraesophageal nodes	6 (46.15%)	25 (29.07%)	3 (6.25%)
Right recurrent nerve nodes	7 (53.85%)	24 (27.91%)	5 (10.42%)
Right paratracheal nodes	5 (38.46%)	21 (24.42%)	2 (4.17%)
Left paratracheal nodes	6 (46.15%)	8 (9.30%)	2 (4.17%)
Subcarinal nodes	6 (46.15%)	49 (56.98%)	15 (31.25%)
Middle paraesophageal nodes	6 (46.15%)	59 (68.60%)	5 (10.42%)
Right pulmonary hilar nodes	–	11 (12.79%)	4 (8.33%)
Lower paraesophageal nodes	–	33 (38.37%)	13 (27.08%)
Diaphragmatic nodes	–	2 (2.33%)	1 (2.08%)
Posterior mediastinal nodes	–	11 (12.79%)	3 (6.25%)
Infraaortal arch nodes	2 (15.38%)	5 (5.81%)	2 (4.17%)
Right paracardiac nodes	4 (30.77%)	40 (46.51%)	22 (45.83%)
Left paracardiac nodes	–	10 (11.63%)	10 (20.83%)
Lesser curvature nodes	–	14 (16.28%)	12 (27.75%)
Greater curvature nodes	–	–	1 (2.08%)
Left gastric artery nodes	1 (7.69%)	51 (59.31%)	22 (45.83%)
Common hepatic artery nodes	–	13 (15.17%)	14 (29.17%)
Celiac nodes	2 (15.38%)	18 (20.93%)	10 (20.83%)
Splenic hilar nodes	–	-	1 (2.08%)
Splenic artery nodes	1 (7.69%)	10 (11.63%)	3 (6.25%)

One to four nodes were positive in 57 patients (46.7%), 5–7 nodes were positive in 39 patients (32%), and more than seven were positive in 26 (21.3%). The frequency of the metastatic involvement of lymph nodes depending on tumor invasion of esophageal wall layers is shown in Table 3.

Thus, even in T_1–T_2 tumors mediastinal or abdominal lymph nodes are involved up to 80% of cases. However, in T_3–T_4 stages the frequency of lymph nodes involvement is significantly higher ($P < 0.05$). The postsurgical stage and TNM classification were as follows: stage I in three patients (2%), stage IIa in 20 (13.6%), stage IIb in 29 (19.7%), stage III in 54 (36.8%), and stage IV in 41 (27.9%) (Table 4).

M1 disease was established when metastases in non-regional lymph nodes were detected, so no patient had distant organ metastasis. In one patient with T_1 tumor (squamous cell carcinoma less than 1 cm in mucosa) the single metastasis was detected in common hepatic artery node.

For 56 patients the operation was characterized as palliative due to distant lymphogenous metastases, adjacent organ or resected margin invasion by tumor or eight and more regional lymph node metastases. Postoperative radiation therapy was given to five patients (3.4%).

Table 3
Involvement of lymph nodes depending on depth of tumor invasion

Tumor invasion	No. of patients	Patients with N_1 disease
Mucosa and submucosa	16	13 (81.3%)
Muscularis propria	32	20 (62.5%)
Adventitia	81	73 (90.1%)
Adjacent structures	18	16 (88.9%)
Total	147	122 (83.0%)

3.2. Morbidity, mortality and survival

The operative mortality rate was 6.1% (CI_{95} 2.3–9.7%). Postoperative pneumonia was the most common cause of death (seven patients); one patient died of an acute cardiovascular insufficiency, and one of a thromboembolism of pulmonary artery. Complications occurred in 62 patients (42.1%, CI_{95} 34.2–49.8%). Postsurgical complications are listed in Table 5.

No esophagogastric anastomosis failure was observed. Empyema and mediastinitis were caused by air leaks,

Table 4
Staging of patients according TNM (UICC, 1987 [6])

Stage	TNM	No. of patients (%)
I ($n = 3$)	$T_1N_0M_0$	3 (2.0)
IIa ($n = 20$)	$T_2N_0M_0$	12 (8.2)
	$T_3N_0M_0$	8 (5.4)
IIb ($n = 29$)	$T_1N_1M_0$	11 (7.5)
	$T_2N_1M_0$	18 (12.2)
III ($n = 54$)	$T_3N_1M_0$	39 (26.5)
	$T_4N_0M_0$	2 (1.4)
	$T_4N_1M_0$	13 (8.8)
IV ($n = 41$)	$T_1N_0M_1$	1 (0.7)
	$T_1N_1M_1$	1 (0.7)
	$T_2N_1M_1$	2 (1.4)
	$T_3N_1M_1$	34 (23.1)
	$T_4N_1M_1$	3 (2.0)

Table 5
Morbidity after extended 2-field subtotal esophagectomy

Complications	No. of patients	No. who died from them
Pneumonia	56 (38.1%)	7 (4.7%)
Pulmonary thromboembolism	1 (0.7%)	1 (0.7%)
Cardiovascular insufficiency	1 (0.7%)	1 (0.7%)
Sepsis	6 (4.1%)	
Necrosis of gastric graft	1 (0.7%)	
Pylorospasm	3 (2.0%)	
Mediastinitis	3 (2.0%)	
Pleural empyema	3 (2.0%)	
Abdominal abscess	2 (1.4%)	
Postoperative bleeding	1 (0.7%)	
Postoperative wound infection	3 (2.0%)	
Right vocal cord paresis	7 (4.8%)	
Left vocal cord paresis	1 (0.7%)	
Bilateral vocal cord paresis	1 (0.7%)	

graft necrosis or pneumonia. Gastric graft partial necrosis required reexploration, and new anastomosis was formed.

The overall 1-year survival rate was 77.2% (CI_{95} 70.2–84.2%), 3-year 50.6% (CI_{95} 40.5–60.7%) and 5-year 28.8% (CI_{95} 15.1–42.5%) (median survival 36.1 months). At last follow-up, three patients, in stage I, were alive.

The 3- and 5-year survival rates for patients in stage IIa were 73.7% (CI_{95} 52.7–94.7%) and 59% (CI_{95} 28–90%); for those in stage IIb, 60.2% (CI_{95} 39.2–81.2%) and 39.5% (CI_{95} 12.5–66.5%); for those in stage III, 57.3% (CI_{95} 39.5–75.1%) and 26.7% (CI_{95} 1–53.3%); and for those in stage IV, 19.8% (CI_{95} 3.7–36.6%) and 0% (Fig. 1).

Lymph node involvement was associated with a decreased 3- and 5-year survival rate: 47.4% (CI_{95} 35.9–58.9%) and 12.9% (CI_{95} 0–31.8%) versus 68.6% (CI_{95} 46.5–90.7%) and 54.8% (CI_{95} 25–84.6%) for patients with no nodal involvement ($P < 0.05$). The number of positive lymph nodes also affected survival. If one to four lymph nodes were positive, the 3-year survival rate was 51.7%, 5-year survival rate was 18.3%; if 5–7 lymph nodes were

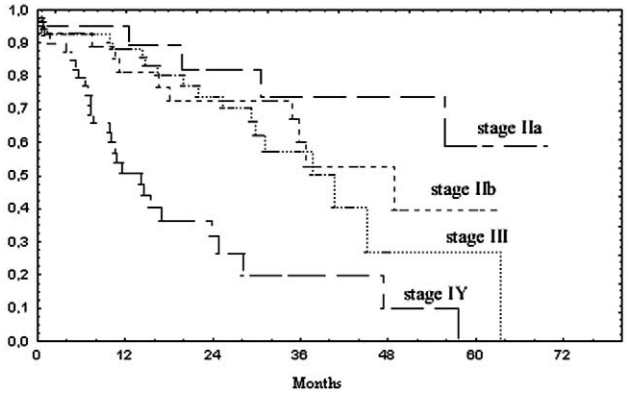

Fig. 1. Survival (death from any cause) of patients undergoing Ivor Lewis esophagectomy with 2F lymph node dissection for cancer by TNM (UICC, 1987 [6]) stage. Zero time on abscissa represents date of esophageal resection.

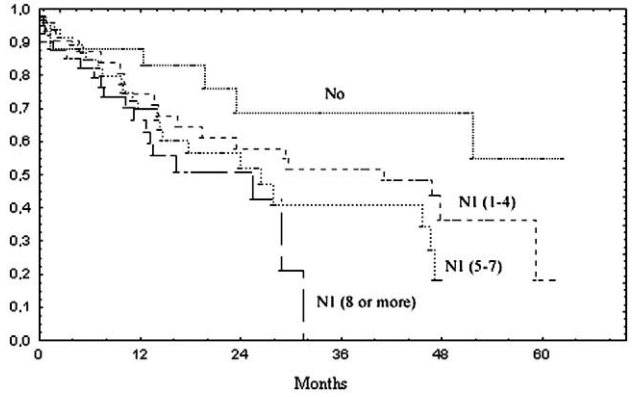

Fig. 2. Survival of patients undergoing Ivor Lewis esophagectomy for cancer without lymph node involvement compared with patients with 1–4, 4–7, and eight or more positive lymph nodes.

positive, 3- and 5 year survival rates were 41.3% and 0%; while if eight or more lymph nodes were positive, they were 0% (Fig. 2).

Because of the very small number of patients who received radiotherapy after operation (5), and because of the retrospective nature of this study, the patients were not stratified, and no tests for significance between their survival data have been performed. Detection of local recurrence was available for nine patients. Six of them had recurrence in cervical lymph nodes. System recurrent disease was documented in 71 patients.

4. Discussion

Esophagectomy with extended 2- or 3-field lymph node dissection is the basic treatment in many clinics [10–14]. During last 15 years we have not routinely been using preoperative chemotherapy or radiation therapy for thoracic esophageal cancer, primary resection being our method of treatment.

The patients in this series were a select group because of the nature of our referral practice. In this study we analyze only patients underwent subtotal esophagectomy with extended 2-field lymph node dissection. Only in cases of distant metastases or locally advanced disease with adjacent organ massive invasion, when the radicality of operation is doubtful, do we perform standard 2-field lymph node dissection. Total mediastinal lymph tissue dissection was our choice taking into account the high incidence of all mediastinal node involvement, including paratracheal nodes and recurrent nerve chain.

Patients with positive lymph nodes at operation had a poor prognosis. It must be noted that prognosis deteriorates in proportion to the number of lymph nodes involved. The difference in survival between patients with positive nodes and those with negative nodes was significant. However, some patients with positive lymph nodes will survive long-term after resection.

As to 3-field lymph node dissection, data of other authors [15–17] and our experience make us consider this procedure justified for thoracic esophagus cancer. Our local recurrence pattern also supports a more radical lymph node dissection. Nevertheless, in almost all patients systemic recurrent disease was detected.

Some different approaches have been described for the surgical resection of esophageal cancer. Nevertheless, we use an Ivor Lewis approach for patients with thoracic esophageal carcinoma for several reasons. This approach allows complete visualization of all abdominal lymph nodes, thoracic esophagus and mediastinal lymph tissue. During last 6 years, we have not used the left thoracoabdominal approach because upper mediastinal lymph nodes are not available in this approach, and performing an anastomosis in the apex of the left chest (above aortic arch) is difficult and requires mobilization of the aortic arch. As to total esophagectomy with cervical anastomosis, we consider that this procedure is indicated for cancer of tracheal segment of esophagus. On the one hand the transthoracic subtotal esophagectomy is a radical operation for esophageal cancer localized in aortal segment of the esophagus or lower. On the other hand cervical anastomoses are characterized by a higher rate of failure, stenosis, disturbance of swallowing coordination and aspiration [18–20]. Besides, total esophagectomy often needs reconstruction with a long isoperistaltic gastric tube. This ensures worse functionality of esophageal substitute [21].

We do not use a transhiatal approach for esophageal cancer, because it does not allow direct visualization of the thoracic esophagus and all mediastinal lymph tissue, and adjacent structure resection is not possible when needed. And again this procedure implies cervical anastomosis. The problem of anastomotic failure in the chest after an Ivor Lewis procedure was not a problem in our series.

As other authors [22] have already pointed out, respiratory complications continue to be an important source of morbidity after transthoracic esophagectomy. Our most common complication also was pneumonia, despite prolonged thoracic epidural analgesia, sanation bronchoscopies, aspiration precautions, aggressive antibiotic therapy, et cetera.

We also do not perform pyloroplasty or other drainage procedure. The pylorospasm after an Ivor Lewis procedure was not a significant problem in our series. Only three patients showed symptoms of pylorospasm, and their management by single endoscopic bougienage was successful.

However, overall survival remains low. Our overall 5-year survival rate was 28.8%. Certainly, influencing of stage has an effect. In our series most of the patients (64.7%) had stage III or IV disease. After obtaining an effective regimen, multimodality treatment may be helpful for these patients.

Finally, squamous cell carcinoma was the most common type of esophageal malignancy. Despite a rising incidence of adenocarcinoma of the esophagus, especially in reports of Western clinics [23,24], squamous cell carcinoma of the esophagus remains the dominant type in Russia.

References

[1] Lewis I. The surgical treatment of carcinoma of the oesophagus. With special reference to a new operation for growths of the middle third. Br J Surg 1946;34:18–31.

[2] Bosset JF, Gignoux M, Triboulet JP, Tiret E, Elias D, Loza'ch P, Schloegel M, Mantion G, Mercier M, Bienvenu G. Randomized phase III clinical trial comparing surgery alone vs. preoperative combined radiochemotherapy (XRT-CT) in Stage I-II epidermoid cancer of the thoracic esophagus. Preliminary analysis: a study of the FFCD (French group) N 8805 and EORTC N 40881 (Meeting abstract). Proc Annu Meet Am Soc Clin Oncol 1994;13:A576.

[3] Walsh TN, Noonan N, Hollywood D, Kelly A, Keeling N, Hennessy TPJ. A comparison of multimodal therapy and surgery for esophageal adenocarcinoma. N Engl J Med 1996;335:462–467.

[4] Kelsen DP, Ginsberg R, Pajak TF, Sheahan DG, Gunderson L, Mortimer J, Estes N, Haller DG, Ajani J, Kocha W, Minsky BD, Roth JA. Chemotherapy followed by surgery compared with surgery alone for localized esophageal cancer. N Engl J Med 1998;339:1979–1984.

[5] Ide H, Eguchi R, Nakamura T, Hayashi K, Hanashi T, Kobayashi A, Hanyu F, Murata Y, Yamada A. Evaluation of lymph node dissection for thoracic esophageal cancer based on preoperative staging. In: Peracchia A, editor. Recent advances in diseases of the esophagus. Selected papers of the 6th World Congress of the ISDE, Bologna: Monduzzi Editore, 1995. pp. 377–383.

[6] Committee on TNM Classification. TNM classification of malignant tumors, 4th fully revised ed. Berlin: Springer, 1987. pp. 40–42.

[7] Metha CL, Patel NR. A network algorithm for performing Fisher's Exact Test in rxc contingency tables. J Am Stat Assoc 1983;78:427–437.

[8] Kaplan EL, Meier P. Nonparametric estimation from incomplete observations. Am Stat Assoc 1958;53:457–481.

[9] Mantel N. Evaluation of survival data and two new rank order statistics arising in its consideration. Cancer Chemother Rep 1966;50:163–170.

[10] Akiyama H, Tsurumaru M, Udagawa H. Radical lymph node dissection for cancer of the thoracic esophagus. Ann Surg 1994;220(3):364–373.

[11] Fujita H, Kakegawa T, Yamana H, Shima I, Toh Y, Tomita Y, Yamasaki K, Higaki K, Naoke T. Mortality and morbidity rates, postoperative course, quality of life and prognosis after extended radical lymph node dissection for esophageal cancer. Comparison of three-field lymph node dissection and two-field lymph node dissection. Ann Surg 1995;222(5):654–662.

[12] Collard JM. Extensive lymph node clearance for cancer of the esophagus or cardia: merits and limits in reference to 5-year absolute survival. Hepatogastroenterology 1995;42(2):619–627.

[13] Jacobi CA. Systematic lymph node dissection in esophageal carcinoma preliminary results of a prospective randomised study. Zentralbl Chir 1996;121(2):110–115.

[14] Skinner DB, Little AB. En bloc resection for neoplasms of the esophagus and cardia. J Thorac Cardiovasc Surg 1983;85:59–71.

[15] Baba M, Aikou T, Yoshinaka H, Natsugoe S, Fukumoto T. Long term results of subtotal esophagectomy with three-field lymph node dissection for carcinoma of the thoracic esophagus. Ann Surg 1994;219(3):310–316.

[16] Isono K, Ochiai T, Koide Y. More or less surgery for esophageal cancer, indications for extended three-field lymph node dissection for esophageal cancer. Dis Esophagus 1994;7:147–150.

[17] Tabira Y, Kitamura N, Yoshioka M, Tanaka M, Nakano K, Toyota N, Mori T. Significance of three-field lymph node dissection for carci-

noma of the thoracic esophagus based on depth of tumor infiltration, lymph nodal involvement and survival rate. J Cardiovasc Surg (Torino) 1999;40(5):737–740.

[18] Yong MM, Deschamps C, Trastek VF, Allen MS, Miller DL, Schleck CD, Pairolero PC. Esophageal reconstruction for benign disease: early morbidity, mortality, and functional results. Ann Thorac Surg 2000;70:1651–1655.

[19] Nurnberger HR, Lohlein D. Experiences with the collar and thoracal anastomoses after subtotal esophagectomy regarding safety and complication rate. Zentralbl Chir 1994;119(4):233–239.

[20] Svanes K, Stangeland L, Viste A, Varhaug JE, Gronbech JE, Soreide O. Morbidity, ability to swallow, and survival, after oesophagectomy for cancer of the oesophagus and cardia. Eur J Surg 1995;161(9):669–675.

[21] Collard JM. The stomach as an esophageal substitute after total or subtotal esophagectomy. Louvain: Faculty of Medicine, Catholic University Louvain, 1997.

[22] Chu KM, Law SY, Fok M, Wong J. A prospective randomized comparison of transhiatal and transthoracic resection for lower-third esophageal carcinoma. Am J Surg 1997;174:320–324.

[23] Pera M, Cameron AJ, Trastek VF, Carpenter HA, Zinsmeister AR. Increasing incidence of adenocarcinoma of the esophagus and esophagogastric junction. Gastroenterology 1993;104:510–513.

[24] Visbal AL, Allen MS, Miller DL, Deschamps C, Trastek VF, Pairolero PC. Ivor Lewis esophagogastrectomy for esophageal cancer. Ann Thorac Surg 2001;71:1803–1808.