

Esophagectomy for Carcinoma of the Esophagus in the Elderly

Results of Current Surgical Management

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Objective

This study aims to evaluate the risk of esophagectomy in the elderly compared with younger patients and to determine whether results of esophagectomy in the elderly have improved in recent years.

Summary Background Data

An increased life expectancy has led to more elderly patients presenting with carcinoma of the esophagus in recent years. Esophagectomy for carcinoma of the esophagus is associated with significant morbidity and mortality, and advanced age is often considered a relative contraindication to esophagectomy despite advances in modern surgical practice.

Methods

The perioperative outcome and long-term survival of 167 elderly patients (70 years or more) with esophagectomy for carcinoma of the esophagus were compared with findings in 570 younger patients with esophagectomy in the period 1982 to 1996. Changes in perioperative outcome and survival between 1982 to 1989 and 1990 to 1996 were separately analyzed.

Results

The resection rate in the elderly was 48% (167/345), lower than the 65% (570/874) resection rate in younger patients ($p < 0.001$). There were significantly more preoperative risk factors

and postoperative medical complications in the elderly, but no significant differences were observed in surgical complications. The 30-day mortality rate was higher in the elderly (7.2%) than in younger patients (3.0%) ($p = 0.02$), but the hospital mortality rate was not significantly different in the elderly (18.0%) and younger age groups (14.4%) ($p = 0.27$). The long-term survival after curative resection in elderly patients was worse than younger patients ($p = 0.01$). However, when deaths from unrelated medical conditions were excluded from analysis, survival was similar between the two age groups ($p = 0.23$). A comparison of data for the periods 1982 to 1989 and 1990 to 1996 revealed that the resection rate had increased from 44% to 54% in the elderly, with significantly fewer postoperative complications and lower 30-day and hospital mortality rates. Long-term survival has also improved, although this has not reached a statistically significant level.

Conclusions

With current surgical management, esophagectomy for carcinoma of the esophagus can be carried out with acceptable risk in the elderly, but intensive perioperative support is required. The improved results of esophagectomy in the elderly in recent years are attributed to increased experience and better perioperative management. Long-term survival was similar to that of younger patients, excluding deaths caused by unrelated medical conditions.

Because of the recent worldwide increase in the elderly population, surgeons have been confronted with the dilemma of whether to perform a major operation in an elderly patient.

Higher postoperative morbidity and mortality rates after major surgery in the elderly are well recognized, and advanced age has been considered a significant risk factor.¹⁻⁴ Postoperative morbidity and mortality rates in the elderly vary with the type of operation performed.^{5,6} Esophagectomy is a major procedure with high risk, and advanced age assumes even greater importance. The risk of esophagectomy for carcinoma of the esophagus in the elderly has not been well documented. The

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few studies comparing the results of esophagectomy in elderly patients with younger patients have shown poorer outcomes in the elderly,⁷⁻⁹ but outcomes similar to younger patients have also been reported.¹⁰

A previous study in our department conducted between 1964 and 1980 showed that advanced age was a highly significant factor for increased mortality after esophagectomy.¹¹ In the present study, the results of esophagectomy for carcinoma of the esophagus in the elderly in our department from 1982 to 1996 were analyzed by comparing results in the elderly (70 years or more) with those of younger patients (<70 years), and results in the elderly who underwent esophagectomy in the period 1982 to 1989 with those operated in 1990 to 1996. A comparison of these two periods was made to determine if results of esophagectomy in the elderly had changed with increased experience of the surgical team and improved perioperative management.

There is no established definition as to when a patient is considered elderly in relation to surgery, but most studies in the literature regard patients aged 70 years or more as being elderly.^{1,5,7-10}

PATIENTS AND METHODS

Between January 1982 and June 1996, esophagectomy was performed in 737 (60%) of 1219 patients with carcinoma of the esophagus managed in the Department of Surgery, The University of Hong Kong at Queen Mary Hospital. Our patients were unselected, including those referred directly from general practitioners or the accident and emergency department, and consisted of the full spectrum of esophageal cancer patients. Results in 167 patients age 70 or older were compared with those of 570 younger patients. Among the elderly, 84 patients were operated during the period 1982 to 1989, and data obtained were compared with those of 83 patients operated during the period 1990 to 1996. Analyses were performed using a prospectively collected and computerized database established since 1982.

All patients had detailed preoperative risk assessment based on history, symptoms, and signs of chronic lung or heart disease, chest x-ray, electrocardiogram (ECG), arterial blood gas analysis, pulmonary function tests, and biochemical and hematologic tests. The preoperative risk factors analyzed included chronic respiratory disease or abnormal lung function (forced expiratory volume at 1 second [FEV₁] <70% of predicted normal), cardiac disease or abnormal ECG, cirrhosis, chronic renal disease, and diabetes mellitus. A patient was considered to have moderate pulmonary risk if the FEV₁ was <70% with normal arterial blood gas measurements, and high pulmonary risk if the FEV₁ was <50% or if the arterial blood gas analysis showed hypoxemia or carbon dioxide retention. A patient with a history of ischemic heart disease, controlled heart failure, or abnormal ECG was considered to be at moderate cardiac risk, and a patient with a history of recent myocardial infarction or

heart failure refractory to treatment was considered to be at high cardiac risk. In general, patients at high cardiopulmonary risk would not be considered for esophagectomy, but patients at moderate risk would receive resection if there were no other contraindications.

All patients were managed in the intensive care unit for the immediate postoperative period. The need for special postoperative supportive measures was analyzed, including inotropic support, ventilatory support, tracheostomy, bronchoscopy, and total parenteral nutrition.

The 30-day mortality rate and hospital mortality rate of patients were studied. Hospital mortality was defined as death within the same hospital admission after surgery, up to 6 months after operation.

Resection was defined as curative when the tumor was confined to the esophagus with or without involvement of adjacent lymph nodes and all macroscopic tumor had been removed. Resection was palliative when there was infiltration of the tumor beyond the esophagus into mediastinal organs or when there was residual tumor after resection.

Statistical Analysis

Comparisons between groups were performed using the chi square test (or Fisher's exact test when the number was small). The Kaplan-Meier method was used to calculate survival rates, and comparisons of survival were performed using the log-rank test. A *p* value of <0.05 was considered statistically significant.

RESULTS

Comparisons Between Elderly and Younger Patients

Resectability and Type of Operation

The characteristics of patients with esophagectomy in the elderly and younger groups are shown in Table 1. The higher proportion of women in the elderly group probably reflects the longer life expectancy of women in our population. There were no significant differences in histology, level of tumor, and operative staging. The resection rate in the elderly was 48% (167/345 patients), significantly lower than the resection rate of 65% (570/874 patients) in younger patients (*p* < 0.001). Among patients who did not have resection, 22 (6%) elderly and 27 (3%) younger patients had lesions that were potentially resectable but refused operation (*p* < 0.01), 111 (32%) elderly and 244 (28%) younger patients were deemed to have unresectable tumors because of advanced or metastatic disease (*p* = 0.15), and 45 (13%) elderly and 33 (4%) younger patients did not undergo resection because of poor general status or high cardiopulmonary risk (*p* < 0.01). Resection was considered curative in 85 (51%) of the elderly and 223 (39%) of the younger patients (*p* < 0.01). Significantly more transhiatal and fewer

Table 1. PATIENT DEMOGRAPHICS

	≥70 Years (%)	<70 Years (%)	p Value
No. of patients	167	570	
Mean age ± SD (years)	74.8 ± 4.7	58.8 ± 6.8	
Sex (Male/Female)	127/40	503/67	<0.001
Histology			NS
Squamous cell carcinoma	150 (90)	518 (91)	
Adenocarcinoma	3 (2)	19 (3)	
Other carcinomas*	14 (8)	33 (6)	
Level of tumor			NS
Cervical	8 (5)	26 (4)	
Upper-third	16 (10)	32 (6)	
Mid-third	94 (56)	328 (58)	
Lower-third	47 (28)	168 (29)	
Double location	2 (1)	16 (3)	
Stage†			NS
I	6 (3)	12 (2)	
II	31 (19)	96 (17)	
III	123 (74)	430 (75)	
IV	7 (4)	32 (6)	

* Anaplastic carcinoma, mucoepidermoid carcinoma and adenosquamous carcinoma.

† AJCC classification.¹²

NS, not significant.

transthoracic esophagectomies were performed in the elderly (Table 2).

Preoperative Risk Factors, Morbidity, and Postoperative Support

There were significantly more patients with pulmonary and cardiac disease in the elderly group (Table 3). Postoperative medical complications were encountered more frequently in the elderly, mainly pulmonary and cardiac. There was no significant difference in the number of surgical complications. Although the anastomotic leakage rate was low, it was still the most common surgical complication in each group.

In the postoperative period, more elderly patients required inotropic support, tracheostomy, and bronchoscopy (Table 4). Ventilatory support and total parenteral nutrition also were more frequently required in the elderly, although the differences were not significant.

Postoperative Mortality

The 30-day mortality rate was 7.2% (12/167 patients) in the elderly and 3.0% (17/570 patients) in the younger group ($p = 0.02$). The hospital mortality rate was 18.0% (30/167 patients) for elderly patients and 14.4% (82/570 patients) for younger patients, with no significant difference ($p = 0.27$). Our hospital mortality included deaths caused by malignant cachexia in 8 elderly and 26 younger patients, because some

of our patients were hospitalized for a prolonged period even after full recovery from surgery because of socioeconomic reasons preventing discharge. There was no significant difference between the two groups in total mortality caused by complications. Twenty-two elderly (13.2%) and 56 younger patients (9.8%) died of postoperative medical or surgical complications ($p = 0.22$) (Table 5).

Long-Term Survival

Of the 737 patients who underwent esophagectomy, 694 (94%) had complete follow-up and 43 (6%) were lost to follow-up. Survival after palliative resection was similar in the elderly (median survival 6.3 months) and younger patients (median survival 7.0 months) ($p = 0.75$). After curative resection, median survival was significantly lower in the elderly (16 months) than younger patients (33 months) ($p = 0.01$). The 1-year, 3-year, and 5-year survival rates were also lower in the elderly (58%, 31%, 26%, respectively) than younger patients (78%, 47%, 35%, respectively) ($p = 0.01$) (Fig. 1). Among patients who underwent curative resection, 56 (66%) of elderly patients and 126 (57%) of younger patients had died by the censored date. In elderly patients, 33 (59%) deaths were cancer-related and 23 (41%) deaths were caused by unrelated medical conditions, in contrast to 99 (79%) cancer-related deaths and 27 (21%) unrelated deaths in younger patients ($p < 0.01$). When deaths caused by unrelated medical conditions were excluded from the analysis, median survival was 28 months in the elderly and 37 months in younger patients ($p = 0.23$), and the corresponding 1-year, 3-year, and 5-year survival rates were not significantly different in the elderly (75%, 40%, 32%, respectively) and younger patients (83%, 50%, 37%, respectively) ($p = 0.23$) (Fig. 2).

Comparisons Between 1982 to 1989 and 1990 to 1996

Resectability and Type of Operation

From 1982 to 1989, 84 resections (42 curative, 42 palliative) were performed among 191 elderly patients, and from 1990 to 1996, 83 resections (43 curative, 40 palliative) were performed among 154 elderly patients. The resection rate increased from

Table 2. TYPES OF OPERATIONS

Operation	≥70 Years (%)	<70 Years (%)	p Value
	[n = 167]	[n = 570]	
Transthoracic esophagectomy	119 (71)	489 (86)	<0.001
Transhiatal esophagectomy	42 (25)	71 (12)	<0.001
Thoracoscopic esophagectomy	6 (4)	10 (2)	NS

Figures represent numbers of patients.
NS, not significant.

Table 3. PREEXISTING RISK FACTORS AND POSTOPERATIVE COMPLICATIONS

Factors and Complications	≥70 Years (%) [n = 167]	<70 Years (%) [n = 570]	p Value
Risk factors			
Chronic pulmonary disease or abnormal lung function	72 (43.1)	146 (25.6)	<0.001
Cardiac disease or abnormal ECG	35 (21.0)	71 (12.5)	<0.01
Cirrhosis	4 (2.4)	25 (4.4)	NS
Chronic renal disease	3 (1.8)	6 (1.1)	NS
Diabetes mellitus	11 (6.6)	23 (4.0)	NS
Medical complications			
Pulmonary complications	66 (39.5)	160 (28.1)	<0.01
Cardiac complications	62 (37.1)	117 (20.5)	<0.001
Hepatic failure	2 (1.2)	9 (1.6)	NS
Renal failure	4 (2.4)	11 (1.9)	NS
Stroke	0 (0.0)	1 (0.2)	NS
Surgical complications			
Anastomotic leakage	8 (4.8)	22 (3.9)	NS
Haemorrhage	8 (4.8)	21 (3.7)	NS
Loop gangrene	1 (0.6)	6 (1.1)	NS
Thoracic empyema	4 (2.4)	8 (1.4)	NS
Chylothorax	2 (1.2)	4 (0.7)	NS
Mediastinitis	0 (0.0)	2 (0.4)	NS
Intraperitoneal sepsis	2 (1.2)	5 (0.9)	NS
Wound dehiscence	1 (0.6)	6 (1.1)	NS

Figures represent numbers of patients.
NS, not significant.

44% to 54% (p = 0.07). The types of operations performed were similar in the two periods, except that six thoracoscopic esophagectomies were performed in elderly patients in the later period. The resection rate in younger patients also increased from 63% to 68% (p = 0.12).

Preoperative Risk Factors, Morbidity, and Postoperative Support

Although more cardiopulmonary risk factors were encountered in elderly patients in the later period, there was a

Table 4. POSTOPERATIVE SUPPORT

	≥70 Years (%) [n = 167]	<70 Years (%) [n = 570]	p Value
Inotropic support	27 (16.2)	45 (7.9)	<0.01
Ventilatory support	45 (26.9)	121 (21.2)	NS
Tracheostomy			
Prophylactic	17 (10.2)	21 (3.7)	
Therapeutic	36 (21.6)	86 (15.1)	
Total	53 (31.8)	107 (18.8)	<0.001
Bronchoscopy	106 (63.5)	308 (54.0)	<0.001
Total parenteral nutrition	32 (19.2)	78 (13.7)	NS

Figures represent numbers of patients.
NS, not significant.

significant decrease in postoperative cardiopulmonary complications (Table 6). No significant differences in surgical

Table 5. MORTALITY CAUSED BY COMPLICATIONS

Results	≥70 Years (%) [n = 167]	<70 Years (%) [n = 570]
Deaths	22	56
Medical complications		
Pulmonary complications		
Bronchopneumonia	10 (45.5)	21 (37.5)
Bronchospasm	1 (4.5)	2 (3.6)
Pneumothorax	0 (0.0)	1 (1.8)
Cardiac complications		
Myocardial infarction	2 (9.1)	4 (7.1)
Cardiac failure	1 (4.5)	2 (3.6)
Arrhythmia	0 (0.0)	1 (1.8)
Hepatic failure	1 (4.5)	3 (5.4)
Subtotal	15 (68.2)	34 (60.7)
Surgical complications		
Anastomatic leakage	4 (18.2)	5 (8.9)
Haemorrhage	1 (4.5)	7 (12.5)
Loop gangrene	0 (0.0)	1 (1.8)
Thoracic empyema	1 (4.5)	4 (7.1)
Chylothorax	0 (0.0)	1 (1.8)
Mediastinitis	0 (0.0)	1 (1.8)
Intraperitoneal sepsis	1 (4.5)	3 (5.4)
Subtotal	7 (31.8)	22 (39.3)

Figures represent numbers of patients who died of the complications.

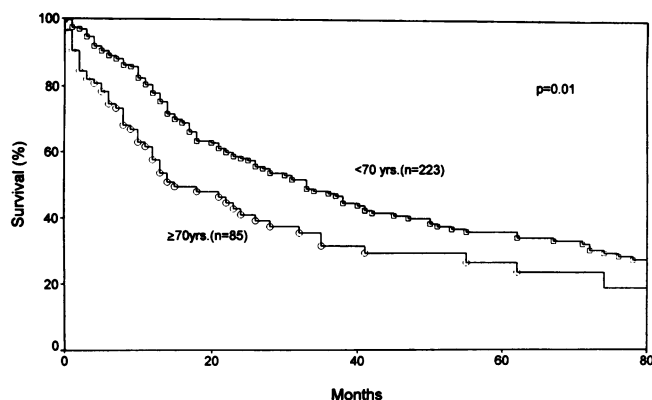


Figure 1. Overall survival after curative resection.

complications were observed, but the anastomotic leakage rate decreased from 7.1% to 2.4%. There was no significant difference in the need for inotropic support (14% vs. 18%), ventilatory support (27% vs. 26%), or tracheostomy (32% vs. 31%) in the two periods. However, bronchoscopy was used much more frequently in the later period (80% vs. 49%) ($p < 0.001$). In younger patients, postoperative cardiopulmonary complications also significantly decreased in the later period.

Postoperative Mortality

The 30-day mortality rate in elderly patients decreased from 11.9% (10/84 patients) in the earlier period to 2.4% (2/83 patients) in the later one ($p = 0.02$). The hospital mortality rate also decreased significantly from 23.8% (20/84 patients) to 12.0% (10/83 patients) ($p = 0.04$). Total mortality caused by complications decreased from 16.7% (14/84 patients) to 9.6% (8/83 patients), although the difference did not reach statistical significance ($p = 0.18$). In younger patients, 30-day mortality rate decreased from 3.5% in the earlier period to 2.2% in the later one ($p = 0.30$), hospital mortality rate decreased from 18.3% to 8.7% ($p < 0.01$), and mortality caused by complications decreased from 13.3% to 4.8% ($p < 0.01$).

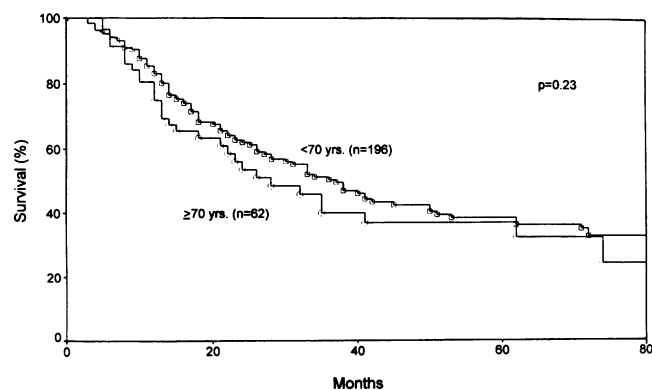


Figure 2. Survival after curative resection, excluding unrelated deaths.

Table 6. RISK FACTORS AND COMPLICATIONS IN ELDERLY PATIENTS DURING TWO PERIODS

Factors & Complications	1982-89 (%) [n = 84]	1990-96 (%) [n = 83]	p Value
Risk factors			
Chronic pulmonary disease or abnormal lung function	33 (39.3)	39 (47.0)	NS
Cardiac disease or abnormal ECG	15 (17.8)	20 (24.1)	NS
Cirrhosis	2 (2.4)	2 (2.4)	NS
Chronic renal disease	2 (2.4)	1 (1.2)	NS
Diabetes mellitus	3 (3.6)	8 (9.6)	NS
Medical complications			
Pulmonary complications	40 (47.6)	26 (31.3)	0.03
Cardiac complications	39 (46.4)	23 (27.7)	0.01
Hepatic failure	1 (1.2)	1 (1.2)	NS
Renal failure	2 (2.4)	2 (2.4)	NS
Surgical complications			
Anastomotic leakage	6 (7.1)	2 (2.4)	NS
Haemorrhage	3 (3.6)	5 (6.0)	NS
Thoracic empyema	2 (2.4)	2 (2.4)	NS
Chylothorax	1 (1.2)	1 (1.2)	NS
Intraperitoneal sepsis	2 (2.4)	0 (0.0)	NS
Wound dehiscence	1 (1.2)	0 (0.0)	NS

Figures represent numbers of patients. NS, not significant.

Long-Term Survival

Median survival after curative resection for elderly patients increased from 14 months in the earlier period to 32 months in the later one. The 1-year, 3-year, and 5-year survival rates increased from 50%, 22%, and 18%, respectively, to 73%, 42% and 23%, respectively, but the overall differences were not statistically significant ($p = 0.11$) (Fig. 3). When deaths caused by unrelated medical conditions were excluded, median survival was 22 months in the earlier period and 33 months in the later one. The 1-year, 3-year, and 5-year survival rates after curative resection were 67%,

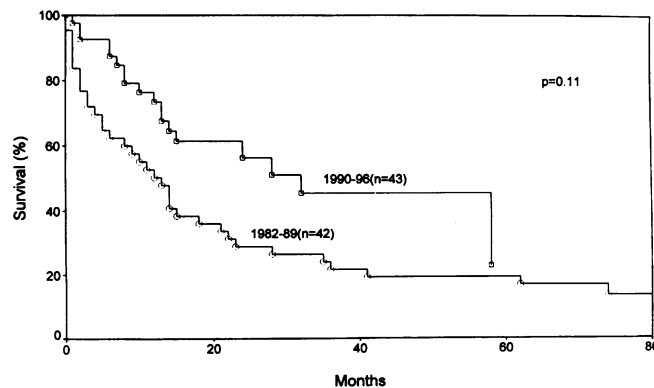


Figure 3. Survival of elderly patients after curative resection in two periods.

36%, and 24%, respectively, in the earlier period and 81%, 46% and 36%, respectively, in the later one ($p = 0.22$). Median survival after palliative resection in the elderly increased from 6.0 months to 6.7 months ($p = 0.25$). There was no significant improvement in the survival of younger patients after curative resection (median survival 33 months in both periods) or palliative resection (median survival 6.9 months in the earlier period, 7.2 months in the later).

DISCUSSION

In the past, advanced age has been considered a contraindication to major surgery because of the high operative mortality rate. Recent studies have established the safety of various types of elective major surgery in the elderly, such as gastric and colorectal surgery, because of advances in surgical techniques and perioperative care.^{13,14} Esophagectomy for carcinoma probably has the highest operative mortality of any elective surgical procedures.¹⁵ A mean operative mortality rate of 29% was reported in a collective review of the 20-year period up to 1980.¹⁶ A more recent review found substantial improvement in the 1980s, but the mean operative mortality rate of 8% was still high.¹⁵ Consequently, advanced age is still considered a contraindication to esophagectomy.¹⁷

More elderly patients now have esophageal carcinoma, in part because of increasing life expectancy, and it is thus important to quantify the risk of esophagectomy for carcinoma in the elderly. Although most previous studies reported higher mortality in the elderly,⁷⁻⁹ one study reported no difference in morbidity and mortality between elderly and younger patients.¹⁰ The resection rate for elderly patients in the latter series was 28%, with 45% of elderly patients in the series excluded from resection because of advanced age, poor physical condition, or specific disease (*e.g.*, diabetes), and the good results could be partly attributed to patient selection.¹⁰ Other authors reported mortality rates of 13% to 18% in smaller series of elderly patients after esophagectomy for carcinoma, but no comparison was made with younger patients.¹⁸⁻²⁰

To our knowledge, this is the largest series so far reported of elderly patients with esophagectomy for carcinoma. The resection rate of 48% was high in an unselected group of elderly patients with esophageal carcinoma. Resection was offered whenever possible because it is our view that this offers the only hope of cure and the best method of palliation.²¹ Advanced age alone was not a contraindication to resection. The oldest patient operated in our series was 91 years of age, with survival for 21 months after palliative resection. The presence of risk factors is more important, and thorough preoperative assessment was carried out in all patients.²² Even in the presence of medical risk factors, resection was still preferred for the elderly unless the risk was prohibitively high. Most of our patients who did not have resection were unresectable because of extensive local or metastatic disease; only 13% of elderly patients were deemed unresectable because of poor physical condition or cardiopulmonary status. Elderly patients had a

higher proportion of curative resection when compared with younger patients, indicating a tendency to operate on less advanced tumors in the elderly.

Cardiopulmonary diseases were the main risk factors in elderly patients, and cardiopulmonary complications occurred much more frequently in this group. No difference in other medical or surgical complications was found. The anastomotic leakage rate was low in both elderly and younger patients, but this remained the main surgical complication. Compared with a previously reported anastomotic leakage rate of 18% after esophagectomy in our institution during the period 1964 to 1982, the present leakage rate (overall 4%) was much lower.²³ The mortality rate from anastomotic leakage also decreased from 54.6% in the period 1964 to 1982 to 30% in the present study.²³

The 30-day mortality rate for the elderly in our series was 7.2%, but this underestimated mortality from esophagectomy because some patients with serious complications were maintained in the intensive care unit for >30 days and died afterwards. Neither was hospital mortality an accurate reflection of operative mortality: in our practice, it included a significant number of patients who remained in the hospital and died of malignant cachexia months after recovering from the operation. The mortality rate caused by medical or surgical complications in elderly patients was 13.2%, which was slightly higher but comparable to that of younger patients, despite higher cardiopulmonary risk and more cardiopulmonary complications in the elderly. The similar outcome was probably the result of more intensive postoperative cardiopulmonary support in the elderly. Pulmonary complication was the most common cause of postoperative death in both younger and elderly patients.

In all our patients, chest physiotherapy and incentive spirometry were instituted early before operation. In the postoperative period, bronchoscopic lavage was used very frequently and tracheostomy was performed with a low threshold, not only for treatment of pulmonary complications but also for prophylaxis in patients with pulmonary risk. These measures are particularly important in the elderly, who have limited pulmonary reserve and poor coughing effort. Repeated bronchoscopies were performed in 63.5% of our elderly patients, with a mean of 6.5 times per patient. Some centers advocate routine postoperative mechanical ventilation after esophagectomy,¹⁷ but this precludes early mobilization and disrupts pulmonary defense mechanisms.²⁴

Apart from intensive perioperative support, the more frequent use of transhiatal over transthoracic esophagectomy in our elderly patients may have also contributed to the low pulmonary-related mortality. We tended to avoid thoracotomy in elderly patients with significant pulmonary risk, especially for lower-third tumors. Prospective randomized trials comparing both approaches showed no significant difference in overall morbidity or mortality,^{25,26} but a study

by our institution showed significantly fewer pulmonary-related deaths in patients with higher pulmonary risks using the transhiatal approach.²⁷

The 5-year survival rate after curative resection in the elderly in our series was 26%, similar to figures reported (in the range of 22% to 30%) by other authors.⁸⁻¹⁰ This was lower than the 35% 5-year survival rate in younger patients. More elderly patients died of unrelated medical conditions, and when these deaths were excluded from analysis, the 5-year survival rate of elderly patients was similar to that of younger patients. Survival after palliative resection was similar in both elderly and younger groups because these patients died of esophageal malignancy early, precluding death from other medical conditions.

When compared with the 16-year period before 1980, operative mortality in patients 70 years or older was reduced by two thirds in the period 1982 to 1996.¹¹ A further reduction in operative morbidity and mortality was achieved in the period 1990 to 1996 compared with the period 1982 to 1989. Apart from improvements in intensive care and perioperative management, specific factors have contributed to the better results. First, from 1982 to 1996, all esophagectomies were performed by the same team of surgeons specializing in esophageal surgery; increased experience with surgical techniques and perioperative care have contributed substantially. Second, there has been considerable improvement in postoperative analgesia. Adequate analgesia decreases pulmonary complications by decreasing the disturbances of pulmonary mechanics after thoracotomy or laparotomy and enabling patients to generate effective cough.^{28,29} Before 1989, all our patients received conventional intermittent intramuscular meperidine injections for postoperative analgesia. Since 1990, all patients have received either epidural morphine, patient-controlled analgesia, or continuous intravenous morphine infusions supervised by an anesthetic pain-control service. A study from our institution showed that the latter analgesic techniques were more effective and were associated with a lower incidence of cardiopulmonary complications and mortality.³⁰

Thoracoscopic esophagectomy is a new technique that avoids the risk of blind dissection of the transhiatal approach and may potentially reduce pulmonary complications associated with thoracotomy, especially in the elderly and patients at high pulmonary risk.^{31,32} Since 1994, we have been performing more thoracoscopic esophagectomies. An unpublished study at our institution documented 4 respiratory complications in 18 patients who underwent thoracoscopic esophagectomy without mortality. Further studies are needed to evaluate the benefit of the technique.³³

In conclusion, our study showed that preoperative medical risk factors and postoperative medical complications were more common in the elderly, but operative mortality was comparable to that of younger patients. These encouraging results were attributed to better and more intensive perioperative support in elderly patients, in addition to careful patient selection. Comparing the periods 1982 to 1989 and 1990 to 1996, further improvement has been made in postoperative mortality and morbidity, despite inclusion of

a larger proportion of elderly patients for resection. With current surgical management, the risk of esophagectomy for esophageal carcinoma is acceptably low, even in elderly patients with medical risk factors, but surgery is not recommended for high-risk elderly patients. Long-term survival of elderly patients was similar to that of younger patients when deaths unrelated to esophageal cancer were excluded. Studies are needed to improve survival still further after esophagectomy for carcinoma of the esophagus.

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