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ORIGINAL ARTICLE

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Esophageal cancer: Outcome and potential benefit of esophagectomy in elderly patients

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Abstract

Background: This analysis evaluated the morbimortality and the potential benefit of esophagectomy for cancer in elderly patients.

Methods: Patients who underwent esophagectomy for EC were divided into elderly (≥70 years) and nonelderly (<70 years) groups. The groups were compared regarding patient and tumor characteristics, postoperative morbimortality, and disease-free, overall and cancer-specific survival.

Results: Sixty-one patients were classified into elderly, and 187 into nonelderly groups. The elderly were characterized by a higher rate of WHO score ($p < 0.0001$), higher cardiac ($p < 0.004$) and renal ($p < 0.023$) comorbidities.

The rate of neoadjuvant therapy and especially of neoadjuvant CRT was significantly lower in elderly patients ($p < 0.018$ and $p < 0.007$). Operative morbidity was also higher in this group ($p < 0.024$).

The 30- and 90-day mortality was 8.2 and 11.5%, respectively in elderly patients and 0.5 and 3.2% in nonelderly patients ($p < 0.004$ and $p < 0.012$). This 90-day mortality decreased when specific surgery-related deaths were taken into consideration. OS and DFS were significantly better in the nonelderly group ($p < 0.003$ and $p < 0.005$) while no difference was observed for cancer-specific survival (CSS).

Conclusion: No difference in CSS was observed. Although elderly patients with EC had higher postoperative morbimortality, the age should not be a criterion whether to perform, or not to perform, esophagectomy. This decision must be based on the balance between the patient's general condition and aggressive disease.

KEYWORDS
elderly, esophageal cancer, esophagectomy, outcomes

INTRODUCTION

Esophageal cancer is the eighth most common cancer and the sixth cause of cancer mortality.[1] Unfortunately, treatment remains a therapeutic challenge, with most patients being diagnosed at a locally advanced stage. The approach is multimodal, and surgery constitutes the treatment's keystone and offers the best chance of cure. EC is more frequent in patients between 65 and 74 with a median age of 67 years.[2] Longer life expectancy has increased the number of elderly patients referred for surgical treatment. In this group, comorbidities are more present and increase the operative risk.[3]

The aim of our study was to evaluate the impact of age and associated comorbidities on postoperative morbidity and mortality and follow the long-term survival in patients

TABLE 1 Patient characteristics

Patient characteristics ($N = 248$)	Elderly: ≥70 years ($N = 61$)	%	Nonelderly: <70 years ($N = 187$)	%	*p*-value
Gender – *n* (%)					
Female ($n = 48$; 19,4%)	11	18.0	37	19.8	0.73
Male ($n = 200$; 80,6%)	50	82.0	150	80.2	
Body mass index (kg/m^2)					
Mean	25.3		25.6		
<22	11	18.0	44	24.0	0.37
≥22	50	82.0	143	76.0	
Weight loss					
No or <10%	29	47.5	114	61.0	0.09
>10%	32	52.5	73	39.0	
ASA score					
1	0	0.0	12	6.4	0.037
2	31	50.8	109	58.3	
3	30	49.2	63	33.7	
4	0	0.0	3	1.6	
1–2	31	50.8	121	64.7	0.075
3–4	30	49.2	66	35.3	
Comorbidities					
Cardiac	44	72.1	96	51.3	0.004
Pulmonary	14	23.0	48	25.7	
Renal	7	11.5	7	3.7	0.023
Hepatic	3	4.9	14	7.5	
Diabetes	5	8.2	27	14.4	
Obliterating arteriopathy	2	3.3	11	5.9	
Surgical history					
Yes	49	80.3	150	80.2	0.985
No	12	19.7	37	19.8	
Alcohol					
Yes	50	82.0	160	85.6	0.499
No	11	18.0	27	14.4	
Smoking					
Yes	43	70.5	140	74.9	0.5
No	18	29.5	47	25.1	
WHO performance status					
0–1	47	77.0	185	98.9	<0.0001
2–4	14	23.0	2	1.1	
Nutrional before surgery					
Gastrotomy tube	3	4.9	5	26.7	0.005
Jejunostomy tube	2	3.3	14	74.9	
Parenteral nutrition	7	11.5	2	10.7	
VEMS/CV					
≤70	1	1.8	6	3.5	0.545
>70	53	98.2	166	96.5	

Abbreviation: ASA score, American Society of Anesthesiologists score; CV, pulmonary vital capacity; VEMS, maximal expiratory volume per second; WHO, World Health Organization Performance Status.

TABLE 2 Tumor characteristics

Tumor characteristics	Elderly: ≥70 years (*N* = 61)	%	Nonelderly: <70 years (*N* = 187)	%	*p*-value
Histological classification					
Adenocarcinoma (*n* = 158; 63,7%)	44	72.1	114	61.0	0.077
Squamous cell carcinoma (*n* = 85; 34,3%)	15	24.6	70	37.4	
Other (*n* = 5; 2%)	2	3.3	3	1.6	
Adenocarcinoma					
Well differentiated	8	18.2	31	27.2	0.482
Moderately differentiated	19	43.2	46	40.4	
Poorly differentiated	17	38.6	37	32.4	
Squamous cell carcinoma					
Well differentiated	5	33.3	16	22.9	0.488
Moderately differentiated	9	60.0	42	60.0	
Poorly differentiated	1	6.7	12	17.1	
Tumor location					
Upper	3	4.9	19	10.1	0.25
Middle	8	13.1	39	20.9	
Lower	50	82.0	143	70.0	
Tumor response grade					
0	0	0.0	1	1.7	
1	3	25.0	26	44.8	
2	3	25.0	13	22.4	
3	0	0.0	9	15.5	
4	5	41.7	8	13.8	
5	1	8.3	1	1.7	
TRG 0–2	6	50.0	40	70.0	0.21
TRG 3–5	6	50.0	18	30.0	
Nodal status					
Negative	36	59.0	115	61.5	0.73
Positive	25	41.0	72	38.5	
C-stage					
IA	8	13.1	27	14.5	0.69
IB	13	21.3	27	14.5	
IIA	1	1.6	3	1.6	
IIB	16	26.2	48	25.8	
IIIA	16	26.2	63	33.9	
IIIB	5	8.2	2	1.1	
IIIC	1	1.6	8	4.3	
IV	1	1.6	8	4.3	

undergoing esophagectomy for esophageal cancer. Patients of 70 years old and above were compared to those under 70.

METHODS

Between January 2006 and December 2015, prospectively collected data from the medical records of patients who underwent esophagectomy for cancer in the Department of Digestive Surgery ULB-Erasme-Bordet were retrospectively reviewed. Patients were divided into two groups; elderly (age ≥70 years, elderly group) and nonelderly (age <70 years, nonelderly group) based on age at the time of surgery. Seventy-years is the age cutoff found in most of the esophageal literature.

This study was approved by the ethical committee of Erasme and Bordet.

Variables including patient and tumor characteristics, neoadjuvant and adjuvant treatment, histology results,

TABLE 3 Treatment modalities

	Elderly: ≥70 years		Nonelderly: <70 years		
	(*N* = 61)	%	(*N* = 187)	%	*p*-value
Neoadjuvant treatment					
Yes	27	44.3	115	61.5	0.018
No	34	55.7	72	38.5	
Neoadjuvant chemotherapy					
Yes	18	29.5	54	28.9	0.925
No	43	70.5	133	71.1	
Neoadjuvant chemoradiotherapy					
Yes	9	14.8	61	32.6	0.007
No	52	85.2	126	67.4	
Adjuvant treatment					
Yes	14	23.0	78	41.7	0.008
No	47	77.0	109	58.3	
Adjuvant chemotherapy					
Yes	11	18.0	61	32.6	0.029
No	50	82.0	126	67.4	
Adjuvant chemoradiotherapy					
Yes	3	4.9	17	9.1	0.299
No	58	95.1	170	90.9	
Perioperative jejunostomy					
Yes	15	24.6	54	28.9	0.516
No	46	75.4	133	71.1	

operative morbimortality, and survival were collected and analyzed.

Before esophagectomy, a complete work-up including physical examination, blood test, esophagogram, upper GI endoscopy, endoscopic ultrasound, neck, chest and abdominal computed tomography (CT) scan, and finally positron-emission (PET)-CT, was mandatory to exclude distant metastasis and confirm local resectability. Laparoscopy was performed to rule out any liver metastases or peritoneal carcinosis suspected on CT or PET-CT.

Elderly patients benefit from an oncogeriatric evaluation based on performance status, comorbidity, medical and nutritional assessment, mental state, depression scale, geriatrics syndrome and socioeconomic state.

The American society of Anesthesiologists classification was used to assess the operative risk.

For tumors above the carina, a three-way approach (right anterolateral thoracotomy, laparotomy or laparoscopy, left cervicotomy) with total esophagectomy, manual anastomosis and three field lymphadenectomy was performed. A total pharyngo-laryngo-esophagectomy was achieved, in cases of recurrence or incomplete response after definitive chemoradiotherapy for cervical esophageal tumors, in cases of laryngeal or cervical recurrent nerve involvement, and/or insufficient margins. For tumors below the carina, a subtotal esophagectomy (aortic arch) with circular mechanical anastomosis and two-field lymphadenectomy was achieved (laparotomy or laparoscopy and right anterolateral thoracotomy).

TABLE 4 Surgery modalities

	Elderly: ≥70 years		Nonelderly: <70 years		
	(*N* = 61)	%	(*N* = 187)	%	*p*-value
Type of intervention					
Total esophagectomy	9	14.8	42	22.5	0.111
Partial esophagectomy	52	85.2	138	73.8	
Pharyngo-laryngo-esophagectomy	0	0.0	7	3.7	
Procedure					
1 way	1	1.6	4	2.1	0.172
2 ways	51	83.6	134	71.7	
3 ways	9	14.8	49	26.2	
Resection					
R0	54	88.5	182	97.3	0.011
R1	7	11.5	5	2.7	
Details R1					
Circumferential margin	7	100.0	2	40.0	0.045
Positive margin	4	57.1	1	83.3	
Margin <1 mm	3	42.9	1	16.7	
Proximal margin	0	0.0	3	60.0	
Conduit used					
Stomach	60	98.4	174	93.0	0.358
Colon	1	1.6	8	4.3	
Jejunum	0	0.0	5	2.7	

TABLE 5 Postoperative complications

	Elderly: ≥70 years		Nonelderly: <70 years		
	(*N* = 61)	%	(*N* = 187)	%	*p*-value
Length of in hospital stay (days) - mean	18.31		18.28		
Length of in hospital stay (days) - median	14		14		
Dindo–Clavien global score					
1	23	37.7	112	59.9	0.024
2	21	34.4	45	24.1	
3a	1	1.6	5	2.7	
3b	3	4.9	9	4.8	
4a	6	9.8	9	4.8	
4b	2	3.3	4	2.1	
5	5	8.2	3	1.6	
Anastomotic leakage excluding pharyngolaryngectomy					
Yes	3	4.9	7	3.9	0.73
No	58	95.1	180	96.1	
Dindo–Clavien anastomotic leakage					
1	0	0.0	2	18.2	
2	0	0.0	1	9.1	
3a	1	33.3	1	9.1	
3b	1	33.3	5	45.5	
4a	0	0.0	1	9.1	
4b	1	33.3	0	0.0	
5	0	0.0	1	9.1	
Intra-abdominal/thoracic abscess					
Yes	0	0.0	2	1.1	1
No	61	100.0	185	98.9	
Mediastinitis					
Yes	2	3.3	4	2.1	0.638
No	59	96.7	183	97.9	
Chylothorax					
Yes	1	1.6	2	1.1	0.573
No	60	98.4	185	98.9	
Conduit ischemia					
Yes	1	1.6	1	0.5	0.402
No	60	98.4	186	99.5	
Recurrent/phrenic nerve palsy					
Yes	0	0.0	3	1.6	1
No	61	100.0	184	98.4	
Hemothorax/hematoma					
Yes	0	0.0	0	0.0	1
No	61	100.0	187	100.0	
Splenectomy					
Yes	1	1.6	3	1.6	1
No	60	98.4	184	98.4	
ARDS-ALI/ARI					
Yes	17	27.9	20	10.7	0.001
No	44	72.1	167	89.3	

(Continues)

TABLE 5 (Continued)

	Elderly: ≥70 years		Nonelderly: <70 years		
	(*N* = 61)	%	(*N* = 187)	%	*p*-value
Infectious pneumopathy					
Yes	23	37.7	47	25.1	0.058
No	38	62.3	140	74.9	
Dindo–Clavien pneumonia					
1–2	14	60.9	33	70.2	0.434
3–5	9	39.1	14	29.8	
Atelectasis					
Yes	2	3.3	5	2.7	0.804
No	59	96.7	182	97.3	
Pleural effusion					
Yes	5	8.2	12	6.4	0.633
No	56	91.8	175	93.6	
Empyema					
Yes	1	1.6	4	2.1	1
No	60	98.4	183	97.9	
Intensive Care Unit readmission					
Yes	6	9.8	14	7.5	0.558
No	55	90.2	173	92.5	
Length of stay in ICU readmission (days)					
Mean	0.5		0.8		
Reintervention surgery					
Yes	4	6.6	5	2.7	0.159
No	57	93.4	182	97.3	
Reintervention CT scan					
Yes	0	0.0	2	1.1	0.864
No	61	100.0	185	98.9	
Reintervention endoscopy					
Yes	3	4.9	9	4.8	0.973
No	58	95.1	178	95.2	
Reintervention prosthesis					
Yes	3	4.9	7	3.7	0.685
No	58	95.1	180	96.3	

Statistical considerations and analysis

Patient characteristics were analyzed descriptively using frequency tables or summaries for continuous variable settings. The proportions of complications were estimated and the confidence intervals at 95% were accurately calculated.

Overall survival (OS) was measured as the time from the date of surgery to the time of last follow-up or death of any cause. Disease-free survival (DFS) was defined as the time from surgery to the first disease-free failure event (local or distant disease relapse or death). Cancer-specific survival (CSS) was calculated as the probability of survival, censoring noncancer causes of death. The cutoff date for analysis was February 02, 2021. Follow-up was calculated using the reverse Kaplan–Meier method. Distributions of time until an event were estimated using the Kaplan–Meier method. Median survival times as well as the 1-, 2- and 3-year survival rates (with confidence intervals at 95%) were calculated. Difference between the survival curves were assessed using the log-rank test. The X^2 test or Fisher's test were used to compare proportion. The patients were managed and operated by the same surgeon, reinforcing the homogeneity of the populations.

Clinicopathological variables analyzed with a *p*-value <0.05 on log-rank test were entered into Cox proportional hazards multivariate analysis. All multivariate Cox models were built according to the rule of 10 events per variable.

TABLE 6 Recurrence and mortality

	Elderly: ≥70 years		Nonelderly: <70 years		
	(*N* = 61)	%	(*N* = 187)	%	*p*-value
Recurrence					
Yes	21	34.4	87	46.5	0.098
No	40	65.6	100	53.5	
Follow-up (mean days)	1438.6		2041.2		
Follow-up (mean months)	48.0		68.0		
Salvage					
Yes	4	6.6	17	9.1	0.791
No	57	93.4	170	90.9	
Mortality					
Yes	41	67.2	99	52.9	0.051
No	20	32.8	88	47.1	
Operative mortality ≤30 days					
Yes	5	8.2	1	0.5	0.004
No	56	91.8	186	99.5	
Mortality ≤90 days					
Yes	7	11.5	6	3.2	0.012
No	54	88.5	181	96.8	
Causes of death					
Surgery related	4	9.8	3	3.0	0.003
Cancer recurrence related	16	39.0	68	68.7	
Other	21	51.2	28	28.3	
Causes of death ≤90 days					
Surgery related	2	28.6	2	33.3	1
Cancer recurrence related	2	28.6	1	16.7	
Other	3	42.8	3	50.0	
Survival					
1 year	41	67.2	162	86.6	0.001
2 years	32	52.5	131	70.1	0.02
3 years	26	42.6	115	61.5	0.01
4 years	24	39.3	104	55.6	0.04
5 years	22	37.7	96	51.9	0.04

All significant tests were two-sided, and all used a 5% level of significance. Statistical analyses were performed using SPSS software (version 22.0; SPSS).

RESULTS

Patient characteristics

The study population consisted of 248 consecutive patients; 200 males (80.6%) and 48 females (19.4%), who underwent esophagectomy for esophageal cancer between January 2006 and December 2015 (Table 1).

The median age of the patients was 62 years. There was 61 patients (age ≥70 years) in the elderly group and 187 patients (age <70 years) in the nonelderly group.

Patient characteristics were almost similar except for significant higher cardiac and renal comorbidities in the elderly group ($p < 0.004$ and $p < 0.023$ respectively). The elderly group was characterized by a higher rate of WHO PS 2–4 ($p < 0.0001$). Almost 65% of nonelderly group patients presented a lower ASA score: 1 or 2. The malnutrition rate was similar in the two groups.

Tumor characteristics

A total of 158 patients presented with an adenocarcinoma (64%) and 85 with a squamous cell carcinoma (34%). The repartition was the same in both groups. Most of the tumors were located below the carina (78.6%) and were classified as stage III (38.3%) according to UICC 2009. No significant

TABLE 7 Multivariate analysis overall survival

Variables	HR	95% CI	*P*-value
Age <70	1	1.29–2.85	0.001
Age ≥70	1.91		
ASA 1–2	1	0.39–0.79	0.001
ASA 3–4	0.56		
Weight loss >10% before surgery			
Yes	1	0.55–1.12	0.188
No	0.78		
Neoadjuvant treatment			
No	1	0.58–1.27	0.439
Yes	0.86		
Adjuvant treatment			
Yes	1	1.29–2.80	0.001
No	1.90		
Histological differentiation			
Well	1		0.098
Moderate	1.72	1.03–2.88	
Poor	1.37	1.02–2.05	
Resection margins			
R0	1	0.19–0.73	0.004
R1	0.37		
Nodal status			
N1	1	0.50–1.08	0.114
N0	0.73		
Nodal ratio			
<0.2	1	1.04–2.74	0.033
≥0.2	1.69		
pT stage			
T1–T2	1	1.03–2.20	0.039
T3–T4	1.50		

Note: HR >1 denotes higher risk of death.
Abbreviations: CI, confidence interval; HR, hazard ratio.

TABLE 8 Multivariate analysis DFS

Variables	HR	95% CI	*P*-value
Age <70	1	1.29–2.85	0.001
Age ≥70	1.81		
ASA 1–2	0.64	0.46–0.90	0.01
ASA 3–4	1		
Weight loss >10% before surgery			
Yes	1.14	0.80–1.63	0.46
No	1		
Neoadjuvant treatment			
No	1	0.53–1.24	0.89
Yes	0.81		
Adjuvant treatment			
Yes	0.54	0.36–0.81	0.003
No	1.		
Histological differentiation			
Well	1		0.28
Moderate	1.29	0.81–2.04	
Poor	1.75	1.07–2.86	
Resection margins			
R0	1	1.23–5.06	0.01
R1	2.49		
Nodal status			
N1	1	0.87–2.05	0.18
N0	1.94		
Nodal ratio			
<0.2	1	0.71–2.10	0.47
>0.2	1.22		
pT stage			
T1–T2	1	1.09–2.31	0.015
T3–T4	1.59		

Note: HR >1 denotes higher risk of death.
Abbreviations: CI, confidence interval; DFS, disease-free survival; HR, hazard ratio.

difference was observed in the clinical stages of the tumor (Table 2).

Treatment modalities

Unfortunately, neoadjuvant therapy was significantly less recommended in the elderly group (44.3%/61.5%; $p < 0.018$) and especially CRT (14.8%/32.6%; $p < 0.007$). Elderly patients received less adjuvant chemotherapy (18%/32.6%; $p = 0.029$) (Table 3).

Surgery and postoperative complications

A subtotal esophagectomy was performed in most of the cases ($n = 190$; 76.6%). A total of 51 patients underwent total esophagectomy and seven patients from the nonelderly group a pharyngo-laryngo-esophagectomy. Tubulized stomach was used for reconstruction in most of the cases (94.35%). Only 14 patients had a jejunum ($n = 5$) or colon ($n = 9$) interposition. No difference in the mean number of harvested lymph nodes was observed (18 lymph nodes) and the positive nodes on total node ratio was 39% (Table 4–5).

According to the European pathological classification, the R1 resection was significantly higher in the elderly group (7/61 [11.48%] vs. 5/187 [2.67%], $p = 0.011$). Indeed, seven patients had a positive circumferential margin (<1 mm) compared to two in the younger group. In the nonelderly group, three patients had a positive proximal margin, and two were missed on frozen section. In one patient in the elderly group and two in the nonelderly group the resection was considered R1 following a salvage surgery.

TABLE 9 Multivariate analysis cancer specific survival

Variables	HR	95% CI	*p*-value
Age <70	1	0.63–2.03	0.67
Age ≥70	1.13		
ASA 1–2	1	0.91–2.23	0.12
ASA 3–4	1.42		
Weight loss >10% before surgery			
Yes	1	0.86–2.21	0.18
No	1.38		
Neoadjuvant treatment			
No	1	0.52–1.51	0.65
Yes	0.88		
Adjuvant treatment			
Yes	1	1.58–4.45	<0.001
No	2.65		
Histological differentiation			
Well	1		0.14
Moderate	1.43	0.73–2.77	
Poor	1.97	0.98–3.96	
Resection margins			
R0	1	1.72–7.97	0.001
R1	3.70		
Nodal status			
N0	1	0.84–2.24	0.201
N1	1376		
Nodal ratio			
<0.2	1	1.15–3.76	0.016
≥0.2	2.07		
pT stage			
T1–T2	1	1.18–3.62	0.009
T3–T4	1.96		

Note: HR >1 denotes higher risk of death.
Abbreviations: CI, confidence interval; HR, hazard ratio.

The length of hospital stay was comparable in both groups (mean: elderly group: 18, 31 days; nonelderly group: 18, 28 days. median: 14 in both groups).

Considering the Dindo–Clavien general score, operative morbidity was higher in the elderly group ($p = 0.024$).

In this group, patients experienced more respiratory infectious complications and acute respiratory distress syndrome (ARDS).

Fourteen patients presented an anastomotic leak (14/248; 5.6%); two cervical, eight thoracic and four following pharyngo-laryngo-esophagectomy. This number decreased to 10 patients if the four patients from the nonelderly group who underwent a salvage pharyngo-laryngo-esophagectomy (10/241; 4.1%) are excluded. No significant difference in anastomotic leak rate was observed between the two groups (4.9%/3.9%; $p = 0.73$).

The rate of ICU readmission and reintervention for complications were not significantly different.

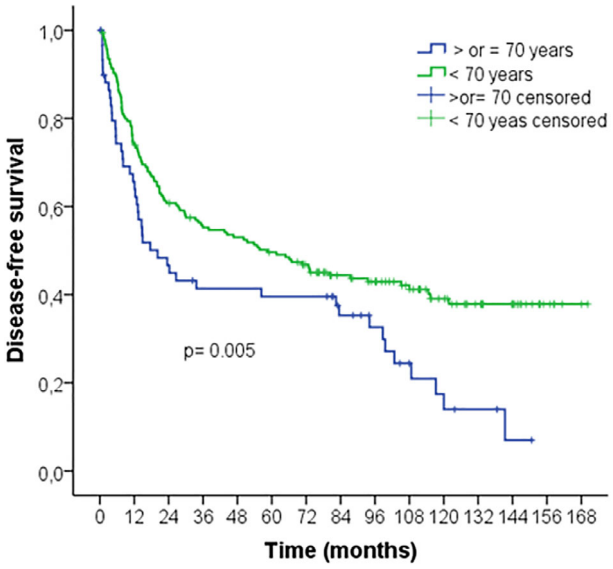

FIGURE 1 Disease free-survival stratified by age.

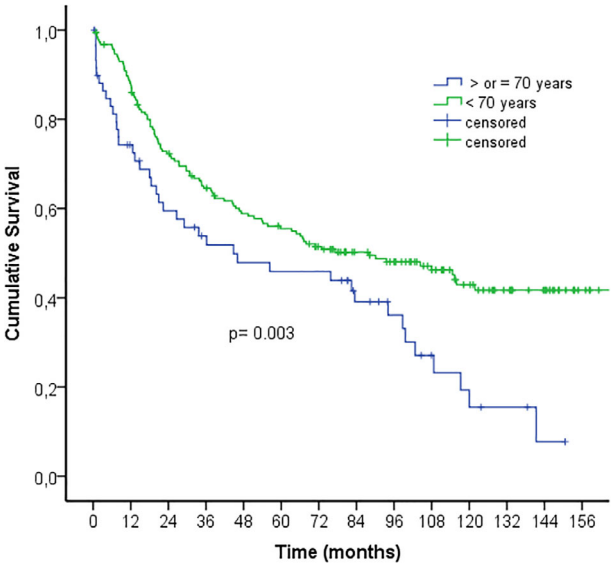

FIGURE 2 Overall survival stratified by age.

Recurrence and mortality

The median follow-up was 54.9 months for all patients at the time of data cutoff (Tables 6–9, Figures 1–3).

The 30 and 90-day postoperative mortality was 8.2% (5/61) and 11.5% (7/61), respectively in the elderly group and 0.5% (1/187) and 3.2% (6/187) in the nonelderly group ($p = 0.004$ and $p = 0.012$). This 90-day mortality rate decreased to 3.3% (2/61), and 1.1% (2/187) ($p = 0.59$), respectively when we consider specific surgery-related deaths.

In the elderly group, two patients died from cancer spread, three of aspiration and arrythmia and two of surgically-related complications. On the other hand, in the

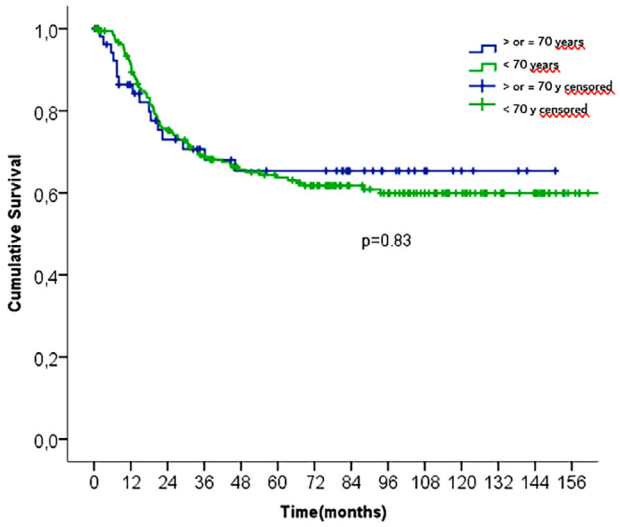

FIGURE 3 Cancer specific survival stratified by age.

nonelderly group, one patient died from cancer spread, one of massive aspiration, one of bronchomalacia, one in a traffic accident and two of surgically-related complications.

The overall 1- and 3-year survival rate was 67 and 43%, respectively in the elderly group versus 87 and 61% in the nonelderly group ($p = 0.001$ and $p = 0.01$). The DFS was longer in younger patients (58.4 months [95% CI: 28.7–88.2]) as compared with elderly patients (20.2 months [95% CI: 8.1–32.2]), $p = 0.005$ (Figure 1). When considering overall survival, patients <70 years have a significantly longer OS (median: 88.0 months [95% CI: 52.1–123.8]) as compared with ≥70 years patients (median:44.8 months [95% CI:12.4–96.8], Figure 2). In the multivariate model adjusted for potential prognostic factors, age was an independent prognostic factor for both DFS (Table 8) and OS (Table 7).

Interestingly, age failed to influence CSS in the univariate (Figure 3) and multivariate analyses (Table 9).

DISCUSSION

Esophageal cancer is the eighth most common cancer and the sixth cause of cancer mortality worldwide.[1] The diagnosis is more frequent in patients between 65 and 74 with a median age of 67 years.[2]

Not so long ago, advanced age was considered as a relative contraindication to major surgery such as esophagectomy. Indeed, this surgery has been associated with higher rates of perioperative mortality.[3–5]

In recent years, there has been an increase in the number of elderly patients undergoing surgery for esophageal cancer. Whether the prognosis of this group of patients is more unfavorable than that in younger patients remains controversial.

In the study by Finlayson et al.,[6] operations for esophageal cancer were found to present the highest mortality rate in octogenarian compared to lung or pancreatic cancer.

From the analysis of the National Cancer Database (NCDB), Vlacich et al.[4] pointed out the survival benefit from any tumor-directed therapy and even palliative treatment in elderly patients with locally advanced esophageal cancer. The trimodal approach offered the best survival benefit and its use increased over time. The authors identified different factors impacting the treatment results and advised caution and care in the choice of the most appropriate approach.

Little data exists regarding the feasibility of neoadjuvant therapy in elderly patients, especially chemoradiotherapy (CRT). In our experience, despite no significant difference in the cTNM classification between the two groups, elderly patients received significantly less neoadjuvant treatment ($p = 0.018$), in particular less CRT ($p = 0{,}007\%$), probably due to the reluctance of our oncologists and the associated comorbidities in this group. In a series of 312 consecutive patients who underwent esophagectomy for esophageal cancer, Rice et al. compared the outcome of ≥70 year old patients who received neoadjuvant therapy with those who did not, and those younger than 70 years who received preoperative treatment. No increase in major postoperative complications in the elderly was observed, but postoperative atrial arrythmias were more likely to develop.[7]

Even in the presence of medical risk factors, resection is still preferred for the elderly unless the risk is prohibitively high. Cardiopulmonary diseases are the main risk factors in these patients. In a study by Poon et al., 13% of patients were deemed unresectable because of poor physical condition or cardiopulmonary status.[3] Our elderly patients presented a higher rate of cardiac ($p = 0.004$) and renal ($p = 0.023$) comorbidities as compared to their younger counterparts. Moreover, the rate of WHO PS 2–4 showed a significant difference between the two groups ($p < 0.0001$). These findings were shared by other authors.[8]

The Dindo–Clavien score was significantly higher in elderlypatients ($p = 0.024$). More recent reviews and pooled analysis pointed out this higher incidence of postoperative morbidity.[1,8,9] Similarly, Cijs et al. observed a greater rate of nonsurgical complications in elderly patients.[10] For others, the postoperative morbidity seemed comparable to younger patients with a cutoff for elderly patients at 80 years or greater.[11]

Pulmonary complications were found to be the most common cause of postoperative death in both young and elderly patients.[3,5,8,12,13] They represent 33% of postoperative cause of mortality in our series. In Sunpaweravong et al., pneumonia was observed in 22.8% of their patients.[14] In a pooled analysis, the rate of pulmonary complications varied from 4% to 56% in elderly patients.[15] These results strongly suggest that greater preoperative precautions must be taken to manage cardiopulmonary complications, particularly in elderly patients. We are in agreement that the primary aim of postoperative esophagectomy care should be the prevention of pulmonary complications such as aspiration and pneumonia by preoperative rehabilitation and also checking the swallow function before resuming oral intake

with fiberoptic endoscopy or cineradiography,[16] our preference being the latter. In our experience, despite careful patient selection and preoperative rehabilitation, including smoking and alcohol cessation, preoperative physical exercises, and respiratory physiotherapy, we reached an overall rate of 28% of pulmonary infections and 15% of acute respiratory distress syndrome (ARDS). Major respiratory complications occurred much more in elderly patients ($p < 0.058$) with a significant higher ARDS rate ($p = 0.001$).

The overall anastomotic leak rate was 5.6% (14/248). This rate dropped to 4.1% if we exclude four patients from the nonelderly who underwent a salvage pharyngo-laryngo-esophagectomy (10/241); indeed the risk of such complication is higher after these procedures. No significant difference was observed in the leak rate between the two groups (elderly: 4.9%, nonelderly: 3.9%). Unfortunately, despite this low rate, leak remains a severe surgical complication. Similarly, Ruol et al. obtained a 7.5% leak rate in elderly patients compared to 10,2% in the other group.[8] Sunpaweravong et al. reported a leak incidence of 15.9% in patients with locally advanced stage of disease.[14]

The hospital length of stay was similar in both groups (median: 14 days). No significant difference was observed in the literature.[6,11]

In esophageal cancer surgery, the primary objective is to perform an R0 resection,[17,18] and the status of resection is not affected by patient age.[2,8] In our series, the rate of circumferential R1 resection, defined by the European pathologists was significantly higher in elderly patients, which is probably due to the lower rate of neoadjuvant CRT in this group.

The 30 ($p < 0.004$) and 90 day ($p < 0.036$) operative mortality rate was significantly higher in the elderly group. When we consider the specific surgery-related postoperative mortality, the 90-day rates drop to 3.3 and 1.1%, respectively. In the elderly group, two patients died of cancer spread, three of arrythmia and aspiration and two of surgically-related complications. Many of these patients refused therapeutic relentlessness. Our mortality rate is comparable to other studies.[10,15,19-22]

In our series, the 5-year survival rate was significantly higher in the nonelderly group ($p < 0.04$). In the study by Lagergren et al., patients aged 75 and over was an independent risk factor for higher short-term mortality and lower long-term survival.[25] Few studies suggest that there is no correlation between age and long-term survival in cases of appropriate patient selection for surgery, which emphasize that age should not be a barrier to surgery.[1–3,13,23,24,26,27] In the present study, the age impacted the OS and DFS but not the CSS. Indeed, the DFS and OS curves were significantly in favor of nonelderly patients ($p = 0.005$ and $p = 0.003$) but no significant difference between the two groups was observed in the CSS. CSS is probably a better endpoint for comparing the two groups of patients because independently of esophageal cancer, elderly patients have a higher risk of death. Our multivariate analyses confirmed that older age was an independent risk factor for OS and DFS but not for CSS, which indicated that older patients had poorer survival but were not at greater risk of cancer-specific death. This suggests that noncancer-specific mortality was an important competing risk event in this group. Similarly, Aoyama et al.[28] found a significant difference between the two groups in OS and DFS.

Although chronological age should not be a sole criterion for recommending esophagectomy, Schlottmann et al.[19] suggest that the increased rate of mortality in elderly patients is not only explained by the higher incidence of comorbidities in those patients. We share some authors' opinions that selected elderly patients with esophageal or gastroesophageal junction cancer should not be denied surgery.[13,18,29]

In conclusion, the rate of esophageal and gastroesophageal cancer in the elderly went with an increase in life expectancy. Elderly patients may be at increased anesthetic risk and consequently a lower rate of operability. An accurate preoperative assessment and intensive perioperative preparation and care are mandatory for the selection of surgical candidates and may increase the operability rate and decrease postoperative morbidity and mortality. Elderly patients might present a higher morbimortality rate but might present a survival benefit and a better quality of life no matter the type of treatment. We conclude from our data that despite the poorer DFS and OS, elderly patients were not at greater risk of cancer specific death and the noncancer specific mortality was a competing risk event in this group. We believe as do many other authors that selected elderly patients with this disease should not be denied surgery.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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