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Surgical Mortality, Survival, and Quality of Life after Resection for Gastric Cancer in the Elderly

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Abstract. Although there were some studies on clinicopathologic characteristics, operative morbidity, and mortality in elderly patients with gastric cancer, no reports have specifically focused on survival and quality of life after resection. A total of 433 patients aged ≥ 65 years (1987–1994) who underwent gastric resection for gastric adenocarcinoma were studied. Two groups were considered: patients aged 65 to 74 years and those > 74 years. Most of the patients (78.1%) had advanced diseases, and nearly half (41.3%) had associated chronic disease(s). Resections with curative intention were performed in 362 patients (83.6%). The overall operative morbidity rate was 21.7% and mortality rate 5.1%. Although operative procedures were similar in both groups, patients aged >74 years had a higher mortality rate than those aged 65 to 74 years (10.1% vs. 3.5%; $p = 0.034$). Age and extent of gastric resection were two independent factors negatively affecting mortality. The cumulative survival rates for patients who underwent curative resection were 86.2%, 72.4%, 67.2%, 62.9%, and 60.0% at 1, 2, 3, 4, and 5 years, respectively. Nearly all patients (96%) after surgery had normal work and daily activities. Some patients appeared to lack energy (16%) or experienced a period of anxiety or depression. There was no statistical difference in survival and quality of life assessed by the Spitzer index after curative resection between the two groups. Therefore resection with curative intention can be performed for the elderly with acceptable morbidity and mortality rates, possible long-term survival, and good quality of life, but a limited operation should be considered in the very elderly patients.

In recent decades, improved socioeconomic conditions, medical progress, and preventive medicine have lengthened life expectancy in our society and consequently increased the elderly population. On the other hand, although the incidence of gastric carcinoma is falling relative to that of other tumors, it is still a major cause of mortality from cancer in Taiwan [1]. The mean age of our gastric cancer patients was 65 years (range 26–91 years) [2], and it became a difficult problem of how best to treat an aged gastric cancer patient properly.

Elderly patients are often not only malnourished, their condition is complicated by heart, lung, and kidney disorders, diabetes, and hypertension. Furthermore, their functional reserve in various organs is often compromised, making it difficult to select a surgical procedure and to assess patient tolerance to surgical stress. The postoperative mortality rate after major surgery is higher in the elderly [3, 4] because of the severity of their medical and surgical condition [5, 6]. A previous study showed that age is an independent factor affecting mortality but not the postoperative complications [7]. Advocates of a major procedure must document perioperative and long-term results so decisions regarding availability of a procedure can be based on scientific data and not solely on fiscal constraints. In this study, we examined the results of gastric cancer surgery in patients ≥ 65 years of age: palliative resection and extensive resection with curative intention. The perioperative and long-term outcomes, including quality of life (QOL), are reported to allow examination of the risks and benefits of gastric cancer surgery for the elderly.

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Materials and Methods

Based on a prospective database in the Department of Surgery, Veterans General Hospital—Taipei, between December 1987 and December 1994 a total of 796 patients admitted for the treatment of adenocarcinoma of stomach and were enrolled in our study. Of the 687 patients who underwent a gastrectomy, 433 (63%) were 65 years of age or older (Fig. 1). They comprised the basis for this study. The male/female ratio was 11:1. The disproportion in gender reflected the status of our patient population, which consisted of 60% veterans. The average life-span of people in Taiwan is 74.5 years [1], so patients were divided into two groups (those aged 65 to 74 years and those aged >74 years) for the purpose of assessing and comparing clinical outcomes.

We analyzed patient characteristics, disease-related information, data from operative treatment, and early and long-term outcome variables. Postoperative morbidity or mortality was determined in all cases with the operative procedure, regardless of their discharge status or events occurring in still-hospitalized patients beyond 30 days until the patient's actuarial discharge from the hospital.

The operation was considered curative when all the carcinoma, including a ≥ N2 lymph node and the metastatic lesions, was removed, with no extensive metastatic spread to the liver or peritoneum at laparotomy. The scope of the regional lymphadenectomy was carried out as previously described [7]. A ≥ D2

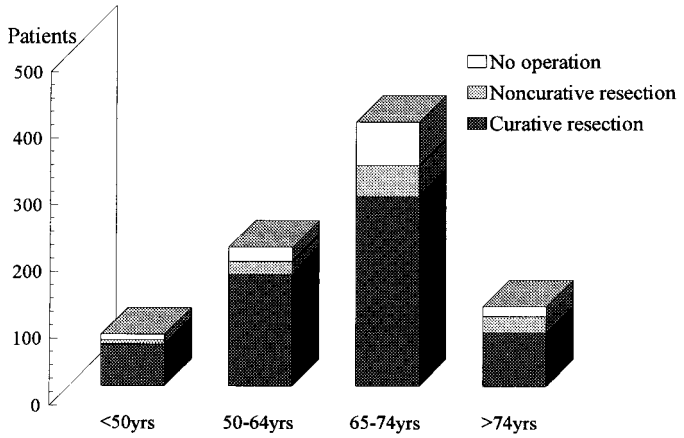


Fig. 1. Age distribution of the patients.

lymph node (N2) dissection removed at least those nodes located in the perigastric tissue along the lesser and greater curvatures and around the blood vessels supplying the stomach that arise from the celiac axis (left gastric, common hepatic, and splenic arteries) [8]. Decisions on whether patients were to undergo surgery and the extent of surgery (Fig. 1) were based on clinical assessment of fitness for surgery after consultation with the anesthetist and internist, the known extent of the disease, and where indicated the QOL after discussion with their relatives.

Because postoperative QOL is an important parameter when judging the treatment result, the QOL was assessed using the Spitzer index [9] at the time of the clinic visit or via telephone inquiry by a research nurse (Li-Ting Shia). The Spitzer index includes five items rated on a three-point scale: activity, daily living, health, support of family and friends, and outlook.

Statistical Analysis

Survival for each variable was estimated by the Kaplan-Meier method [10], and the significance of survival was determined by the log-rank test. Only the variables of statistical significance ($p < 0.05$) were included in a subsequent multivariate analysis for evaluation using the Cox multiple stepwise regression model (BMDP 2L). Other statistical analyses were carried out using the chi-square analysis. A multivariate discriminate analysis using the stepwise logistic regression test was made to determine the independent risk factors related to postoperative mortality.

Results

Preoperative Abnormalities

Nearly one-third of the elderly patients had hypoalbuminemia (< 3.5 g/dl), and one-fifth had anemia (hemoglobin < 10 g/dl). Of the 433 elderly patients, 179 (41.3%) had chronic disease(s) such as hypertension (25.4%), cardiac disease, respiratory system disease, diabetes mellitus, mild cirrhosis, or previous stroke either alone or in various combinations. Among them, 63 patients (35.1%) had more than one chronic disease. Further assessment found that patients over 74 years of age had significantly more chronic diseases (particularly hypertension and respiratory system disease) than those aged 65 to 74 years. The distribution of other abnormalities was not significantly different in the two groups of patients (Table 1).

Pathologic Features

The mean diameter of the tumors was 5.8 ± 3.0 cm. More than half of the tumors were located in the distal stomach (53.1%), were of the intestinal type (56.2%) by Lauren's histologic criteria, and had lymph node metastases (60.0%). Most of the patients (78.1%) had advanced disease. Patients aged > 74 years were more likely to have liver metastasis and advanced-stage disease than those aged 65 to 74 years (Table 2). For patients undergoing curative resection, the pathologic characteristics were similar in patients aged 65 to 74 years and those over 74 years (data not shown).

Surgical Procedures

More than half of the patients (65.1%) had a subtotal gastrectomy; 83.6% of patients underwent resection with $\geq$ D2 lymph node dissection, which was though to be curative at the time of surgery. The most frequent combined resected organs were the gallbladder (21.7%), distal pancreas (15.9%), and spleen (18.7%). In all, 30 gallbladders were removed for concomitant disease (23 stones, 7 polyps) and 64 for suspected ischemia due to extensive dissection around the hepatoduodenal ligament. The average operation time was 6.4 hours, and postoperative hospital stay was 23.7 days. Of the 330 patients in the group aged 65 to 74 years, 283 patients (85.8%) underwent curative resection, and 47 (14.2%) underwent palliative surgery. Among those aged over 74 years, 79 patients (76.7%) underwent curative surgery, and 24 (23.3%) underwent palliative surgery. Although for the surgical procedures performed the operative curability, blood loss, and operative time were similar, patients aged over 74 years had a longer hospital stay than those aged 65 to 74 years (Table 3).

Early Outcome

The overall morbidity rate for all patients after resection was 21.7%, and for patients after curative resection it was 22.1%. The overall mortality rate for all patients after resection was 5.1% and for curative resection 4.7%. For patients who underwent curative resection the morbidity rate in patients aged over 74 years (35.5%) was statistically higher than in those aged 65 to 74 years (19.8%) ($p = 0.044$). The mortality rate in patients aged over 74 years (10.1%) was also significantly higher than in patients aged 65 to 74 years (3.5%) ($p = 0.034$). Most patients who underwent palliative resection did so because of extensive diseases. In particular, two patients underwent palliative resection as an emergency (massive tumor bleeding). One patient with multiple liver metastases (serum albumin 3.2 g/dl) had hematemesis on the fourth postoperative day followed by jaundice, wound infection, and wound dehiscence before he expired. One patient with liver cirrhosis (serum albumin 2.6 g/dl) developed hepatic failure after resection.

Surgically related complications were more frequent than nonsurgically related complications, although their mortality rates were similar (2.5% vs. 2.3%) ($p = 0.83$). Anastomotic leakage (5.0%) and abdominal abscess (4.6%) were the two most frequent

Table 1. Preoperative abnormalities of elderly patients with gastric cancer.

Parameter	All patients (n = 433)	65–74 Years (n = 330)	> 74 Years (n = 103)	p
Hypoalbuminemia < 3.5 g/dl	135 (31.2%)	89 (30.9%)	46 (44.6%)	< 0.001*
Anemia <10 g/dl	93 (21.5%)	69 (20.9%)	24 (23.3%)	0.61
Associated disease				
Hypertension	110 (25.4%)	71 (21.5%)	39 (37.8%)	< 0.001*
Cardiac disease[a]	40 (9.2%)	26 (7.8%)	14 (13.5%)	0.08
Respiratory system disease[b]	35 (8.1%)	16 (4.8%)	19 (18.4%)	< 0.001*
Diabetes mellitus	30 (6.9%)	20 (6.0%)	10 (9.7%)	0.20
Cirrhosis, mild	22 (5.1%)	15 (4.5%)	7 (6.7%)	0.36
Previous stroke	15 (3.5%)	9 (2.7%)	6 (5.8%)	0.13
No. of associated disease(s)				
0	254 (58.7%)	228 (69.1%)	26 (25.2%)	
1	116 (26.8%)	86 (26.1%)	30 (29.1%)	
2	52 (12.0%)	17 (5.2%)	35 (34.0%)	
3	9 (2.1%)	0	9 (8.7%)	
4	2 (0.5%)	0	2 (1.9%)	< 0.001*

[a]Cardiac disease: ischemic heart disease, arrhythmia, previous myocardial infarction, coronary artery disease, hypertensive cardiovascular disease.
[b]Respiratory system disease: asthma, chronic obstructive pulmonary disease.
*Statistically significant.

surgically related operative complications and were the most frequent cause of surgically related death. Postoperative chest infection (with positive sputum culture or radiologic changes) occurred in 10 patients (2.3%). The chest infection and its related mortality were significantly higher in patients aged over 74 years than those aged 65 to 74 years ($p = 0.007$ and $p = 0.007$, respectively). One patient (81 years old) recovered smoothly after operation; but on the day of discharge sudden choking on food led to aspiration pneumonia, and the patient expired owing to sepsis. There was one death due to pulmonary thrombosis. One-fourth of our patients had hypertension, and we postponed surgery in them until adequate blood pressure control was achieved. Unfortunately, three patients with hypertension had strokes after operation, and one died subsequently. We did not give prophylactic subcutaneous heparin, as all patients were catheterized. Postoperative urinary tract infection, based on clinical features and positive urine cultures, was found in three patients, with a urinary infection rate of 0.7%: two aged 65 to 74 years and one aged over 74 years. One patient developed myocardial infarction immediately after operation and recovered later (Table 4). According to the univariate analysis, the location of the tumor, respiratory system disease, operating time, blood loss, age (65–74 vs. > 74 years), combined organ resection, extent of gastric resection (total versus subtotal) were significant factors for operative mortality. In the stepwise logistic regression analysis, age and extent of gastric resection were factors that independently affected mortality. The odds ratio for morbidity after total gastrectomy compared to subtotal gastrectomy was 5.33. Relative to patients aged >74 years, the odds ratio for morbidity of those aged 65 to 74 years was 0.27 (Table 5).

Late Outcome

Throughout the study on 412 patients (excluding 21 operative mortalities), 240 (58.3%) died during the follow-up period. Of them, 180 of the deaths were related to gastric cancer (43.7%), 9 were due to another malignancy (2.2%), 39 were due to another disease (9.5%), and 12 occurred for unknown reasons (2.9%). The overall survival rate for all patients after resection was 82.3% during the first year, 67.1% the second year, 60.0% the third year, 55.8% the fourth year, and 52.9% the fifth year. For those patients who underwent resection with curative intent, the cumulative survival rate was 86.2% the first year, 72.4% the second year, 67.2% the third year, 62.9% the fourth year, and 60.0% the fifth year. There was no survival difference after curative resection in patients aged 65 to 74 years and aged over 74 years (Fig. 2) ($p = 0.92$). Patients aged 65 to 74 years who underwent curative resection had a significantly higher survival rate than those who underwent noncurative resection ($p < 0.001$). A similar tendency was observed in patients aged > 74 years ($p < 0.001$). The survival after palliative resection was not statistically different in the two groups ($p = 0.05$). In uni- and multivariate analyses, tumor gross appearance, cancer lymphatic duct invasion, liver metastasis, and stage were factors that independently affected survival (Table 6).

Assessment for QOL was done for patients aged 65 to 74 years, including 115 disease-free and 10 recurrent patients. Eighteen patients, including two who had migrated to mainland China, one with congestive heart failure, and one with a femoral shaft fracture, could not be assessed. The same assessment was done for 24 disease-free patients and 1 recurrence patient aged over 74 years. Four patients, including one with stroke, were not assessed. Two patients with a Spitzer index of 7 were in the 65–74-year age group; one was receiving chemotherapy. The Spitzer index of the remaining patients was higher than 7 (range 0–10 points). All the patients except the one receiving chemotherapy had normal work and daily activities even with a recurrence. Some patients appeared to lack energy (16%) or experienced a period of anxiety or depression (14%). There was no statistical difference in the Spitzer index scores between patients aged 65 to 74 years and those over 74 years (Table 7).

Discussion

The results of gastric cancer surgery in this study show that curative resection can be performed for elderly patients with an acceptable mortality rate, possible long-term survival, and good QOL. We have performed 362 curative gastric resections (83.6%) with an operative morbidity rate of 22.1% and a mortality rate of 4.7%. The overall cumulative 5-year survival rate was 62.4%.

Table 2. Pathologic characteristics of elderly patients with gastric cancer.

Parameter	All patients (n = 433)	65–74 Years (n = 330)	> 74 Years (n = 103)	p
Tumor diameter (cm), mean ± SD	5.8 ± 3.0	5.7 ± 3.1	6.2 ± 2.9	0.28
Location of tumor in stomach				
Upper	61 (14.1%)	40 (12.1%)	21 (20.3%)	
Middle	109 (25.2%)	90 (27.2%)	19 (18.4%)	
Lower	230 (53.1%)	176 (53.3%)	54 (52.4%)	
Whole	33 (7.6%)	24 (7.2%)	9 (8.7%)	0.90
Gross appearance				
Superficial	125 (28.9%)	101 (30.6%)	24 (23.3%)	
Well-defined	62 (14.3%)	48 (14.5%)	14 (13.6%)	
Ill-defined	246 (56.8%)	181 (54.8%)	65 (63.1%)	0.29
Histology type				
Intestinal	243 (56.2%)	175 (53.0%)	68 (66.0%)	
Diffuse	163 (37.7%)	135 (40.9%)	28 (27.1%)	
Mixed	26 (6.0%)	20 (6.1%)	6 (5.8%)	0.42
Depth of cancer invasion				
Mucosa, submucosa (early)	95 (21.9%)	78 (23.6%)	17 (16.5%)	
Muscle, serosa (advanced)	338 (78.1%)	252 (76.4%)	86 (83.5%)	0.13
Lymphatic duct involvement				
Negative	320 (73.9%)	240 (72.7%)	80 (77.6%)	
Positive	113 (26.1%)	90 (27.3%)	23 (22.4%)	0.32
Vascular involvement				
Negative	35 (8.1%)	25 (7.6%)	10 (9.7%)	
Positive	398 (91.9%)	305 (92.4%)	93 (90.3%)	0.49
Liver metastases				
Negative	410 (94.7%)	318 (96.4%)	92 (89.3%)	
Positive	23 (5.3%)	12 (3.6%)	11 (10.7%)	< 0.01*
Lymph node metastasis				
Negative	173 (40.0%)	140 (42.5%)	33 (32.0%)	
Positive	260 (60.0%)	190 (57.5%)	70 (68.0%)	0.60
Peritoneal dissemination				
Negative	396 (91.5%)	305 (92.4%)	91 (88.3%)	
Positive	37 (8.5%)	25 (7.6%)	12 (11.7%)	0.20
Stage				
I	131 (30.3%)	107 (32.4%)	24 (23.3%)	
II	64 (14.8%)	52 (15.8%)	12 (11.7%)	
III	124 (28.6%)	93 (28.2%)	31 (30.1%)	
IV	114 (26.3%)	78 (23.6%)	36 (34.9%)	0.01*

*Statistically significant.

Although the patients > 74 years who survived the surgery had a good QOL, the high operative mortality (10.1%) suggests that a limited operation can be considered in very elderly patients. Nearly all patients (96%) had normal work and daily activities. Nevertheless, our results do not reflect the outcomes of all elderly patients, as our patients had already gone through a process of selection by their physicians.

Currently, surgical resection is the only effective curative modality for primary treatment of gastric cancer, and it continues to be the major approach for palliation as well. Patients undergoing surgery frequently have medical problems that influence their perioperative course. Because multiple chronic diseases occur with increasing frequency [11, 12], a preoperative comprehensive assessment is the foundation for perioperative management of the elderly patient. Similar to the observation of a high incidence of hypoalbuminemia (40.7%) in gastric cancer patients aged over 80 years by Korenaga et al. [13], we found that the elderly patients had a 31.2% incidence of hypoalbuminema, particularly those over age 74 years (44.6%). Nutritional support via intravenous hyperalimentation is essential in these patients before operation. We also found that elderly patients had a high incidence (41.3%) of chronic disease, such as respiratory system diseases and hypertension, particularly those aged over 74 years (Table 1). According to Korenaga et al., postoperative hypoxemia and decreased functional residual capacity were directly related to advancing age [14]. Ten (2.3%) of our patients had pulmonary infections; three of them (0.7%) who died were over 74 years of age (Table 4). There was one death due to pulmonary thrombosis. Thus pulmonary complications were responsible for most of the nonsurgically related deaths. Hypertension was also common; as many as 37.8% of our patients had a history of hypertension, were already under treatment, or were found to have elevated blood pressure. In contrast to Western society, in which surgical patients with hypertension usually died during the intra- or postoperative period from cardiac failure [15], Taiwanese hypertensive surgical patients usually died from stroke. In this study, three of four patients with hypertension had a stroke, and one died subsequently.

For major surgery in the elderly, patients with emergency surgery with a life-threatening condition are known to have a higher mortality rate than those with elective surgery [16]. The overall mortality rate for all of our patients after resection was 5.1% and for those with curative resection 4.7%. These results were related to the two deaths that occurred after emergency palliative resection for massive tumor bleeding. On the other hand, the data

Table 3. Surgical procedures performed, duration of surgery, and length of postoperative stay.

Parameter	All patients (n = 433)	65–74 Years (n = 330)	> 74 Years (n = 103)	p
Scope of gastric resection				
Total gastrectomy	151 (34.9%)	113 (34.2%)	38 (36.8%)	
Subtotal gastrectomy	282 (65.1%)	217 (65.8%)	65 (63.2%)	0.62
Extent of lymphadenectomy				
< D2	71 (16.4%)	47 (14.2%)	24 (23.3%)	
≥ D2	362 (83.6%)	283 (85.8%)	79 (76.7%)	0.30
Combined resection				
Distal esophagectomy	11 (2.5%)	10 (2.5%)	1 (1.0%)	
Distal pancreaticosplenectomy	69 (15.9%)	54 (16.3%)	15 (14.5%)	
Pancreaticoduodenectomy	1 (0.2%)	1 (0.2%)	0	
Splenectomy	12 (2.8%)	8 (2.4%)	4 (3.9%)	
Partial resection of liver	9 (2.1%)	8 (2.4%)	1 (1.0%)	
Segmental resection of colon	25 (5.8%)	21 (6.0%)	4 (3.9%)	
Cholecystectomy	94 (21.7%)	73 (22.0%)	21 (20.3%)	
Adrenectomy	10 (2.3%)	8 (2.4%)	2 (1.9%)	0.85
Operative curability				
Curative	362 (83.6%)	283 (85.8%)	79 (81.6%)	
Noncurative	71 (16.4%)	47 (14.2%)	24 (18.4%)	0.30
Blood loss (ml)	1012.5 ± 908.5	951.9 ± 718.0	1206.7 ± 1335.0	0.06
Operating time (minutes)	382.0 ± 135.8	384.5 ± 126.0	374.4 ± 163.0	0.10
Postoperative hospital stay (days)	23.7 ± 17.5	21.9 ± 15.0	26.9 ± 22.0	0.03*

*Statistically significant.

Table 4. Patterns of complications and related death by age.

	65–74 Years				> 74 Years			
	Palliative resection (n = 47)		Curative resection (n = 283)		Palliative resection (n = 24)		Curative resection (n = 79)	
Complication	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality
Surgically related								
Anastomotic leakage	2 (4.2%)	0	10 (3.5%)	1 (0.4%)	2 (8.3%)	1 (4.2%)	8 (10.1%)	2 (2.5%)
Abdominal infection	0	0	13 (4.6%)	4 (1.4%)	0	0	8 (10.1%)	3 (8.1%)
Chylous leakage	1 (2.1%)	0	14 (4.9%)	0	0	0	2 (2.5%)	0
Bleeding	0	0	2 (0.7%)	0	3 (12.5%)	1 (4.2%)	1 (1.3%)	0
Wound infection	2 (4.2%)	0	3 (1.0%)	0	1 (4.2%)	0	2 (2.5%)	0
Wound dehiscence	0	0	0	0	1 (4.2%)	0	1 (1.3%)	0
Pancreatic fistula	0	0	2 (0.7%)	1 (0.4%)	0	0	0	0
Pancreatitis	1 (2.1%)	0	1 (0.4%)	0	0	0	0	0
Cholecystitis	1 (2.1%)	0	1 (0.4%)	0	0	0	1 (1.3%)	0
Gastroparesis	0	0	2 (0.7%)	0	0	0	0	0
Nonsurgically related								
Pulmonary infection	0	0	2 (0.7%)[b]	0[c]	2 (8.3%)	1 (4.2%)	6 (7.6%)[b]	2 (2.5%)[c]
Pulmonary thrombosis	0	0	1 (0.4%)	1 (0.3%)	0	0	0	0
Urinary tract infection	0	0	2 (0.7%)	0	0	0	1 (1.3%)	0
Stroke	0	0	3 (1.0%)	1 (0.3%)	1 (4.2%)	1 (4.2%)	0	0
Fungemia	0	0	1 (0.4%)	1 (0.3%)	0	0	0	0
Cardiac	0	0	1 (0.3%)	0	0	0	1 (1.3%)	0
Liver	1 (2.1%)	1 (2.1%)	0	0	1 (4.2%)	0	1 (1.3%)	0
Anesthesia mishap[a]	0	0	1 (0.3%)	1 (0.3%)	0	0	0	0
Suffocation	0	0	0	0	0	0	1 (1.3%)	1 (1.3%)
Total	8 (17.0%)	1 (2.1%)	56 (19.8%)[d]	10 (3.5%)[e]	6 (25%)	4 (16.7%)	24 (35.5%)[d]	8 (10.1%)[e]

[a]Anesthesia mishap: dislodgement of endotracheal tube.
[b]p = 0.02; [c]p = 0.047; [d]p = 0.044; [e]p = 0.034.

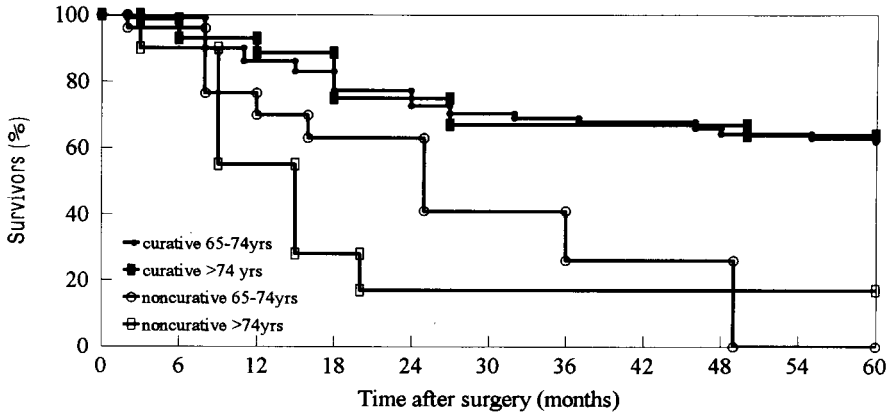
shown in Table 2 indicate that the recovery from surgical insult is limited with advancing age. Patients over 74 years of age had longer postoperative hospital stay than those aged 65 to 74 years, although the operative procedures, operative curability, blood loss, and operating time were similar in the two groups. Furthermore, finding that age is a significant factor for mortality (Table 5) was consistent with previous observations for curative gastrectomy [7]. We also found that the extent of gastric resection was an important factor negatively affecting mortality (Table 5). Therefore limited surgery should be considered for very elderly patients to reduce operative mortality.

In the group of patients with curative resection, the morbidity

Table 5. Factors significantly affecting postoperative mortality using logistic regression analysis.

Variable	β	SE	χ^2	p	OD	95% CI
Extent of gastric resection (total, subtotal)	−1.313	0.489	7.207	0.007	5.33	0.103–0.702
Age (65–74, >74 years)	1.673	0.478	12.252	0.0005	0.27	2.088–13.596

β: coefficient; SE: standard error; χ^2: chi square; OD: odds ratio; CI: confidence interval.



No. at risk

Curative Resection							
65-74years	283	256	231	189	142	105	70
> 74years	79	66	59	46	31	24	13
Non-Curative Resection							
65-74years	47	39	31	22	6	1	0
> 74years	24	15	8	3	3	3	3

Fig. 2. Cumulative survival after surgery in patients aged 65–74 years (filled circles) and those over 74 years (filled squares). Survival in those who did not undergo surgery aged 65–74 years (open circles) and over 74 years (open squares).

rate for those > 74 years of age was not statistically different from those aged 65 to 74 years, but the mortality rate was significantly higher in the older group (10.1% vs. 3.5%) ($p = 0.034$). This mortality rate was lower than that reported for gastrointestinal tumors (17%) [17] but much higher than that reported for gastric cancer from Japan (3.7%) [13]. Kitamua et al. [18], in a retrospective analysis of gastric cancer surgery, found a higher mortality rate in the elderly ≥ 70 years (4.0%) than in those aged 40 to 69 years (1.7%). Walsh [16] analyzed major abdominal surgery in 152 patients ≥ 65 years and disclosed a higher mortality rate for the patients > 80 years of age (33%) than in younger ones (20%). Our previous study also found that patients > 65 years of age had poorer recovery from complications than did those < 65 years [7]. Thus elderly patients tend to have less competence to overcome surgical complication(s). Furthermore, by reevaluating our data we found that three surgically related deaths during the early period of curative gastric resection (learning period) may be "avoidable" deaths [7]. Abdominal abscesses since 1991 have been controlled by a newly developed technique: continuous irrigation using a modified Foley catheter [19]. These results call attention to a single but important principle: that elderly patients should be handled by experienced surgeons to minimize operative complications.

As Maehara and his colleagues reported [20], we also found histopathologic differences between young and elderly patients with gastric cancer [21, 22]. Patients over 74 years of age had more liver metastases and advanced stages than patients aged 65 to 74 years (Table 2). It is worth noting an extended lymphadenectomy (D ≥ 2) rate of 83.6% in our patient population, a cholecystectomy rate of 21.9%, a distal subtotal gastrectomy rate of 65.1%, a distal pancreatectomy rate of 16.2%, and a splenectomy rate of 18.7%. Given the patient characteristics and the mode of data recording, we believe that accurate staging is possible. As there was no substantial difference in operative procedures between the two groups (Table 3), the nature of the presenting pathology, including tumor invasion and metastatic behavior, should be the most important determinant of the outcome for the elderly patients [23] (Table 6). The similar cumulative survival rate in this study between those aged over 74 years and those aged 65 to 74 years suggests that survival correlates with severity of disease rather than age (Fig. 2).

The benefits of a cancer treatment should outweigh its cost in patient suffering. There has been increasing interest in the concept of the QOL of cancer patients, and research related to its measurement has increased. A number of instruments have been proposed for measuring the impact of treatment, but few have been applied. We attempted to use the Functional Living Index—Cancer to measure the QOL in gastric cancer patients; however, most patients circled the numbers on the Visual Linear Analog Scale, although the instrument was administered by a trained nurse. Therefore we used the Spitzer QOL index, which is short, is easily applied, and can be summed into a single score while retaining its domain-specific properties. It has been applied to assess the QOL of patients with esophageal atresia [24], broncho-

Table 6. Factors significantly associated with survival after multivariate analysis using Cox stepwise proportional hazard model.

Variable	β	SE	χ^2	p	OD	95% CI
Borrmann type	0.400	0.161	6.213	0.013	1.49	1.089–2.044
Lymphatic duct involvement	0.860	0.365	5.566	0.018	2.36	1.157–4.829
Hepatic involvement	0.822	0.253	10.545	0.001	2.27	1.385–3.733
Stage	0.844	0.110	58.427	<0.001	2.33	1.873–2.886

See Table 5 for abbreviations.

Table 7. Spitzer index scores after curative resection in aged patients with gastric cancer.

		65–74 Years: time after operation			> 74 Years: time after operation		
Score	Assessments	2–3 Years (n = 47)	4–5 Years (n = 52)	6 Years (n = 26)	2–3 Years (n = 10)	4–5 Years (n = 9)	6 Years (n = 6)
Activity							
2	Works or studies full-time or nearly so	47	52	25	10	9	6
1	Requires major assistance or reduced hours worked	0	0	1	0	0	0
0	Does not work or study	0	0	0	0	0	0
Daily							
2	Self-reliant for daily activities including transport	47	51	26	10	9	5
1	Requires assistance for daily activity	0	1	0	0	0	1
0	Does not manage personal care or light tasks	0	0	0	0	0	0
Health							
2	Appears to feel well most of time	40	42	22	8	8	6
1	Lacks energy more than just occasionally	7	10	4	2	1	0
0	Feels very ill, seems weak	0	0	0	0	0	0
Support							
2	Good relationships and strong support from other(s)	44	42	22	10	7	6
1	Support limited by patient condition	3	10	4	0	2	0
0	Supported only when absolutely necessary	0	0	0	0	0	0
Outlook							
2	Calm and positive in outlook	38	49	23	7	7	5
1	Periods of anxiety or depression	9	3	3	3	2	1
0	Consistently anxious and depressed	0	0	0	0	0	0
Mean		9.69 ± 0.71	9.69 ± 0.67	9.65 ± 0.80	9.50 ± 0.85	9.44 ± 0.88	9.67 ± 0.52
Range 0–10		8–10	7–10	8–10	8–10	8–10	9–10

genic carcinoma [25], esophageal cancer [26], and gastric cancer [27, 28]. In this study it was interesting that the elderly had a good Spitzer index, similar to previous reports for gastric cancer patients aged < 65 years [27]. Although some patients appeared to lack energy (18%) or experienced a period of anxiety or depression (17%), nearly all patients had normal work and daily activities (96%) (Table 7). As the alternative to surgery was almost certain death, these figures strongly support the view that necessary major surgery should not be withheld from the very elderly on the grounds of age alone. For most of them, it prolongs a worthwhile survival.

Résumé

Bien qu'il existe des études concernant les caractéristiques clinicopathologiques, la morbidité et la mortalité après opération pour cancer gastrique chez le sujet âgé, on ne connaît pas de publication spécifique de la survie ou de la qualité de vie après résection. On a analysé les dossiers de 433 patients, âgés de 65 ans ou plus, opérés d'une résection gastrique pour adénocarcinome gastrique entre 1987 et 1994. Les patients ont été divisés en deux groupes: ceux âgés de 65–74 ans et ceux de > 74 ans. La plupart des patients (78.1%) avaient une maladie avancée et presque la moitié (41.3%) avaient des maladies chroniques associées. On a réalisé une résection à visée curative chez 362 patients (83.6%). La morbidité globale opératoire a été de 21.7%, et la mortalité de 5.1%. Bien que les procédés opératoires aient été similaires dans les deux groupes, les patients âgés de > 74 ans avaient une mortalité plus élevée que ceux âgés entre 65–74 ans (10.1% vs. 3.5%; p = 0.034). L'âge et l'étendue de la résection gastrique étaient des facteurs négatifs indépendants de mortalité. Les taux de survie cumulative des patients qui ont eu une résection à visée curative a été de 86.2%, 72.4%, 67.2%, 62.9% et de 60.0% en, respectivement, 1, 2, 3, 4 et 5 ans. Presque tous les patients (96%) ont pu reprendre une activité normale (travail et activité quotidiennes). Chez quelques patients, on a pu observer un manque de forces (16%) ou une période d'anxiété ou de dépression. On n'a observé aucune différence statistiquement

significative en ce qui concernait la survie ou la qualité de vie évaluées avec l'indexe de Spitzer après résection à visée curative. Ainsi, la résection à visée curative peut être effectuée chez le sujet âgé avec une morbidité et une mortalité acceptables, une survie à long terme et une bonne qualité de vie mais une intervention plus limitée doit être envisagée chez le patient très âgé.

Resumen

Si bien hay estudios sobre las características clínicopatológicas, la morbilidad y la mortalidad en pacientes con cáncer gástrico de edad avanzada, no existen informes focalizados sobre supervivencia y calidad de la vida luego de resección quirúrgica. Se estudiaron 433 pacientes con edades $\geq$ 65 años (1987–1994) que habían sido sometidos a resección gástrica por adenocarcinoma. Se consideraron dos grupos: pacientes con edades entre 65 y 74 años, y pacientes $>$ 74 años. La mayoría de los casos (78.1%) presentaba enfermedad avanzada y casi la mitad (41.3%) sufría enfermedad crónica asociada. Se practicó resección con intención curativa en 362 pacientes (83.6%). La tasa global de morbilidad operatoria fue 21.7% y la de mortalidad 5.1%. Aunque los procedimientos operatorios fueron similares en los dos grupos, los pacientes $>$ 74 años registraron una mortalidad más elevada que los de edades entre 65 y 74 (10.1% vs. 3.5%; $p = 0.034$). La edad y la extensión de la resección gástrica aparecieron como factores independientes afectando negativamente la mortalidad. Las tasas acumulativas de supervivencia para los pacientes sometidos a resección curativa fueron 86.2%, 72.4%, 67.2%, 62.9% y 60.0% a los 1, 2, 3, 4 y 5 años, respectivamente. Casi todos los pacientes sometidos a resección regresaron a su trabajo y actividades diarias normales, aunque algunos parecieron estar faltos de energía (16%) o sufrieron un periodo de ansiedad o depresión. No se observó diferencia significativa en la supervivencia o en la calidad de vida medida por el índice de Spitzer luego de resección curativa entre los dos grupos. Por consiguiente, la resección con intención curativa puede ser efectuada en personas de edad avanzada con aceptables tasas de morbilidad y mortalidad, posible supervivencia a largo plazo y buena calidad de vida. Pero en los muy ancianos se debe considerar una operación limitada.

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References

1. 1995 Abridged Life Tables of Taiwan-Fuchien Area of Both Sexes, Department of Statistics, Ministry of Interior, Taipei, 1997, p. 98
2. Wu, C.W., Hsieh, M.C., Lo, S.S., Tsay, S.H., Lui, W.Y., P'eng, F.K.: Relation of number of positive lymph nodes to the prognosis of patients with primary gastric adenocarcinoma. Gut *38*:525, 1996
3. Linn, B.S., Linn, M.W., Wallen, N.: Evaluation of results of surgical procedures in the elderly. Ann. Surg. *195*:90, 1982
4. Canivet, J.L., Damas, P., Desaive, C., Lamy, M.: Operative mortality following surgery for colorectal cancer. Br. J. Surg. *76*:745, 1989
5. Djokovic, J.L., Hedley-Whyte, J.: Prediction of outcome of surgery and anesthesia in patients over 80. J. A. M. A. *242*:2301, 1979
6. Greenburg, A.G., Saik, R.P., Coyle, J.J., Peskin, G.W.: Mortality and gastrointestinal surgery in the aged: elective vs emergency procedures. Arch. Surg. *116*:788, 1981
7. Wu, C.W., Hsieh, M.C., Lo, S.S., Wang, L.S., Hsu, W.H., Lui, W.Y., Huang, M.H., P'eng, F.K.: Morbidity and mortality after radical gastrectomy for patients with carcinoma of the stomach. J. Am. Coll. Surg. *181*:26, 1995
8. Japanese Research Society for Gastric Cancer: Japanese Classification of Gastric Carcinoma, 1st English edition, Tokyo, Kanehara, 1995, pp. 7–16
9. Spitzer, W.O., Dobson, A.J., Hall, J., Chesterman, E., Levi, J., Shepherd, R., Battista, R.N., Catchlove, B.R.: Measuring the quality of life of cancer patients: a concise QL-index for use by physicians. J. Chronic Dis. *34*:585, 1981
10. Kaplan, E.L., Meier, P.: Nonparametric estimation from incomplete observations. J. Am. Stat. Assoc. *53*:457, 1958
11. Fong, Y., Blumgart, L.H., Fortner, J.G., Brennan, M.F.: Pancreatic or liver resection for malignancy is safe and effective for the elderly. Ann. Surg. *222*:426, 1995
12. Tsujitani, S., Katano, K., Oka, A., Ikeguchi, M., Maeta, M., Kaibara, N.: Limited operation for gastric cancer in the elderly. Br. J. Surg. *83*:836, 1996
13. Korenaga, D., Moriguchi, S., Baba, H., Kakeji, Y., Orita, H., Haraguchi, M., Maehara, Y., Ueo, H., Sugimachi, K.: Surgery for gastric carcinoma is feasible for patients over 80 years of age. World J. Surg. *15*:642, 1991
14. Korenaga, D., Baba, H., Kakeji, Y., Orita, H., Haraguchi, M., Maehara, Y., Saku, M., Sugimachi, K.: Comparison of R1 and R2 gastrectomy for gastric cancer in patients over 80 years of age. J. Surg. Oncol. *48*:136, 1991
15. Sprague, H.B.: An analysis of the results of surgery on cardiac patients during the past ten years at the Massachusetts General Hospital. Surg. Gynecol. Obstet. *49*:54, 1929
16. Walsh, T.H.: Audit of outcome of major surgery in the elderly. Br. J. Surg. *83*:92, 1996
17. Morel, P., Egeli, R.A., Wachtl, S., Rohner, A.: Results of operative treatment of gastrointestinal tract tumors in patients over 80 years of age. Arch. Surg. *124*:662, 1989
18. Kitamura, K., Yamaguchi, T., Taniguchi, H., Hagiwara, A., Yamane, T., Sawai, K., Takahashi, T.: Clinicopathological characteristics of gastric cancer in the elderly. Br. J. Cancer *73*:798, 1996
19. Wu, C.W., Chen, Y., Hsieh, M.J., Lui, W.Y., P'eng, F.K.: Use of a modified Foley catheter for continuous irrigation of intra-abdominal abscess. Br. J. Surg. *79*:1296, 1992
20. Maehara, Y., Emi, Y., Tomisaki, S., Oshiro, T., Kakeji, Y., Ichiyoshi, Y., Sugimachi, K.: Age-related characteristics of gastric carcinoma in young and elderly patients. Cancer *77*:1774, 1996
21. Wu, C.W., Tsay, S.H., Hsieh, M.C., Lo, S.S., Lui, W.Y., P'eng, F.K.: Clinicopathological significance of intestinal and diffuse types of gastric carcinoma in Taiwan Chinese. J. Gastroenterol. Hepatol. *11*:1083, 1996
22. Lo, S.S., Wu, C.W., Hsieh, M.C., Kuo, H.S., Lui, W.Y., P'eng, F.K.: Relationship between age and clinical characteristics of patients with gastric cancer. J. Gastroenterol. Hepatol. *11*:511, 1996
23. Wu, C.W., Hsieh, M.C., Lo, S.S., Tsay, S.H.: Prognostic indicators in patients with gastric cancer after resection. Dig. Dis. Sci. *42*:1265, 1997
24. Ure, B.M., Slany, E., Eypasch, E.P., Gharib, M., Holschneider, A.M., Troidl, H.: Long-term functional results and quality of life after colon interposition for long-gap esophageal atresia. Eur. J. Pediatr. Surg. *5*:206, 1995
25. Zieren, H.U., Muller, J.M., Hamberger, U., Pichlmaier, H.: Quality of life after surgical therapy of bronchogenic carcinoma. Eur. J. Cardiothorac. Surg. *10*:233, 1996
26. Zieren, H.U., Jacobi, C.A., Zieren, J., Muller, J.M.: Quality of life following resection of oesophageal carcinoma. Br. J. Surg. *83*:1772, 1996
27. Wu, C.W., Hsieh, M.C., Lo, S.S., Lui, W.Y., P'eng, F.K.: Quality of life of patients with gastric adenocarcinoma after curative gastrectomy. World J. Surg. *21*:777, 1997
28. Fuchs, K.H., Thiede, A., Engemann, R., Deltz, E., Stremme, O., Hamelmann, H.: Reconstruction of the food passage after total gastrectomy: randomized trial. World J. Surg. *19*:698, 1995