LONG-TERM CONSEQUENCES OF GASTRECTOMY PROCEDURES IN GASTRIC CANCER PATIENTS

Kunihiro Iwata, Kyoji Ogoshi, Tomoo Tajima, Hiroyasu Makuuchi

Department of Surgery, Tokai University
Isehara, Kanagawa, Japan.
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Key Words: Total gastrectomy, proximal gastrectomy, distal gastrectomy, immunological markers, histology, and phenotype of lymphocytes.

Abstract
Four hundred forty-two patients underwent gastrectomy for carcinoma of the stomach to determine the impact of various gastrectomy procedures on patients’ prognosis, and to assess the phenotypes of lymphocytes before and after gastrectomy. During the 3-6 postoperative months, there were significant differences between patients who received total gastrectomy and subtotal gastrectomy as regards the CD4+/CD8+ ratio. The 10-year survival rates of patients who received a subtotal gastrectomy were significantly better than those of patients who underwent total gastrectomy. A Cox multivariate analysis revealed that the extent of resection was a significantly related to independent covariate with patient prognosis.

Introduction
The long-term consequences of gastrectomy and its impact on different operative procedures are still a matter of controversy. The optimal extent of surgical resection for adenocarcinoma of the stomach has been a subject of debate. Some surgeons favor total gastrectomy as a radical treatment, while others believe subtotal gastrectomy should be the standard operation in cases where a safe proximal resection margin can be guaranteed. In clinical settings, gastric cancer in the distal part of the stomach has usually been treated with distal subtotal gastrectomy (DG). Total gastrectomy (TG) has been the universally accepted technique for neoplasma located in the proximal area of the stomach, or in case which involve the entire stomach and/or are multifocal. Both procedures are reliable and safe. The indications for proximal gastrectomy (PG) remain

Address correspondence to: Dr. Kyoji Ogoshi, Isehara, Kanagawa, Japan. (TEL: (+81)-(0)463-96-6163; FAX: (+81)-(0)463-96-4120; e-mail: ogoshi@is.icc.u-tokai.ac.jp).
to be clarified. Despite the wide employment of TG, most comparison studies of TG versus DG have failed to provide any convincing data on long-term improvement by TG (Branum 1997). It is thus questionable whether TG is essential, even for carcinomas located in the proximal part of the stomach.

The objective of this study was to determine the impact of various gastrectomy procedures on patient prognosis; the phenotypes of lymphocytes were examined before and during a one-year period after gastrectomy in order to assess changes in phenotypes of the lymphocytes. Seven occasions during the 1-yr period were considered: within 1 week before surgery, 2 weeks, and 1, 3, 6, 9, and 12 months after the surgical intervention.

Patients and Methods

The clinicopathological characteristics of 442 consecutive patients who underwent gastrectomy for carcinoma of the stomach between November 1976 and November 1998 were examined. Tumors of these patients were histologically confirmed as adenocarcinoma of the stomach and were limited to the distal, middle, or proximal area of the stomach; cases were excluded that involved the entire stomach. Three hundred twenty-nine (74.4%) patients were male and 113 (25.6%) were female. The median age at operation was 57 years (range 33-79 years). Patients underwent either total (n=66), subtotal distal (n=346), or proximal gastrectomy (n=30). Patient characteristics are listed in Table I. Among the patients whose tumors were located in the antrum and pylorus, there were significant differences between operative procedures as regards the depth of cancer invasion, lymph node metastasis (p<0.0001), and histology grading (p=0.002). Among the patients whose tumors were located in the corpus, there were significant differences between operative procedures as regards the depth of cancer invasion, lymph node metastasis, tumor size (p<0.0001), histology grading (p=0.015), and lymph node dissection (p=0.011). Among fundus and cardia cases, there were significant differences between operative procedures as regards the depth of cancer invasion, lymph node metastasis, tumor size (p<0.0001), lymph node dissection (p=0.042), and age (p=0.001). The operative procedures were the responsibility of the attending doctor. One of the present authors (Dr. Kyoji Ogoshi) was in the operation team.
Surgical techniques

Extent of gastric resection

In DG and PG groups, the stomach was transected 1 to 2 cm from the pyloric or fundic ring in the lesser curvature, respectively, at the root of the marginal branches of the left gastroepiploic artery and vein, and at two or three marginal branches of the right gastroepiploic artery and vein in the greater curvature, respectively.

Extent of lymph node dissection

In the PG group with D2 or D3 lymph node dissection, the lymph nodes along the right gastroepiploic artery and infrapyloric lymph nodes (Nos. 4d and 6) were removed skeletally, preserving two or three branches of the gastroepiploic artery and vein. The grade of the extent of lymph node dissection was thought to be similar between patients who received TG and PG because the lymph nodes around the stomach were removed either by TG or PG. We 'de principe' reserved the spleen, even in patients with total or proximal gastrectomy. When we preserved the spleen in cases of D2 or D3, the lymph nodes at the splenic hilus (No. 10) and along the splenic artery (No. 11) were also removed skeletally. In twenty-five patients (5.7%), the spleen was removed.

Lymphocyte Subset Analysis

The lymphocyte analysis included measurement of CD4+ cells (T-helper cells) and CD8+ cells (T-suppressor cells). Peripheral blood samples (5 ml) were drawn from each patient into heparinized tubes before surgery (total gastrectomy and subtotal gastrectomy, n=47 and n=271, respectively), and at 2 weeks (total gastrectomy and subtotal gastrectomy, n=3 and n=25, respectively), at 1 month (total gastrectomy and subtotal gastrectomy, n=10 and n=94, respectively), 3 months (total gastrectomy and subtotal gastrectomy, n=12 and n=127, respectively), 6 months (total gastrectomy and subtotal gastrectomy, n=14 and n=131, respectively), 9 months (total gastrectomy and subtotal gastrectomy, n=6 and n=39, respectively), and 12 postoperative months (total gastrectomy and subtotal gastrectomy, n=13 and n=129, respectively). Lymphocytes were separated by Ficoll-hypaque centrifugation. Immunophenotyping was done by flow cytometry using conjugated antibodies to previously characterized epitopes. The
Antibodies used for the identification of lymphocyte subpopulations were OKT4 (CD4+, T-helper cells) and OKT8 (CD8+, T-suppressor cells) obtained from Ortho (Ortho Diagnostic Systems K.K., Tokyo). Immunofluorescence was examined using a FACScan analyzer (Ortho Diagnostic Systems K.K., Tokyo). The percentage of lymphocytes that stained positive for a particular antibody was recorded.

**Statistical Methods**

Survival was assessed from the day of surgery until death. Follow-up information for all patients was obtained by direct contact or by telephone contact with the patients or their families. The median follow-up period was 2555 days (182-7827 days). Survival curves were calculated using the Kaplan-Meier product-limit estimate and differences in survival were assessed by the log-rank test. A two-sided p value obtained from the log-rank test is presented in tables. To identify independent prognostic factors, we used the Cox proportional hazards regression model to relate the following eight covariables: regional lymph node metastasis \([n (-) \text{ versus } n (+)]\), sex (female versus male), age (under 59 versus 60 and over), depth of primary tumor invasion (pt1-t2 versus pt3-pt4), lymph node dissection (D0-D1 versus D2), histological grading (G1-G2 versus G3-G4), extent of resection (total versus subtotal gastrectomy), and tumour size (less than 20 mm versus 20 mm and over). Patients underwent gastrectomy alone without postoperative adjuvant therapy until tumor recurrence.

**Statistics**

Mean values were compared by Student’s t-test. The chi-square test was used to compare the prevalence of characteristics. Results were considered significant when the p value was less than 0.05. All statistical analyses were carried out according to the procedures of SPSS 9.0 (SPSS Inc., Chicago, USA.).

**Results**

Sixty-nine patients (20%) of 346 who underwent DG, 3 (10%) with 30 PG, and 36 (54.5%) with 66 TG died in this investigation. Thirty-eight patients (8.6%) died from gastric cancer, 17 (3.8%) from other malignant diseases, 42 (9.5%) from other diseases; 6 (1.4%) patients who underwent distal gastrectomies died within 30 days after surgery. Five (1.1%) causes of death were unknown. Only one patient who underwent DG died
Figure 1. Survival curves of patients whose tumors were located in the lower stomach and of those who underwent total or distal gastrectomy.

Figure 2. Survival curves of patients whose tumors were located in the middle of the stomach and of those who underwent total, proximal, or distal gastrectomy.
Figure 3. Survival curves of patients whose tumors were located in the upper stomach and of those who underwent total or proximal gastrectomy.

Figure 4. Changes in the number of CD4 T-cells in patients who underwent total or subtotal gastrectomy.
Figure 5. Changes in the number of CD8 T-cells in patients who underwent total or subtotal gastrectomy.

Figure 6. Changes in the CD4/8 ratio in patients who underwent total or subtotal gastrectomy.
### TABLE I
Characteristics of 442 gastric cancer patients according to the location of tumor

<table>
<thead>
<tr>
<th></th>
<th>Antrum and pylorus</th>
<th>Corpus</th>
<th>Fundus and Cardia</th>
</tr>
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<tbody>
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<td></td>
<td>Gastrectomy Total</td>
<td>Gastrectomy Total</td>
<td>Gastrectomy Total</td>
</tr>
<tr>
<td></td>
<td>Distal</td>
<td>Proximal</td>
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<tr>
<td>Total number</td>
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<td>31</td>
</tr>
<tr>
<td>Gender</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>46</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>M</td>
<td>128</td>
<td>134</td>
<td>21</td>
</tr>
<tr>
<td>Age</td>
<td>75</td>
<td>114</td>
<td>12</td>
</tr>
<tr>
<td>~59</td>
<td>99</td>
<td>104</td>
<td>19</td>
</tr>
<tr>
<td>60~</td>
<td>9</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Residual tumour</td>
<td>R1~R2</td>
<td>166</td>
<td>24</td>
</tr>
<tr>
<td>R0</td>
<td>165</td>
<td>167</td>
<td>24</td>
</tr>
<tr>
<td>Primary tumour</td>
<td>pt1~pt2</td>
<td>164</td>
<td>23</td>
</tr>
<tr>
<td>pt3~pt4</td>
<td>9</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Regional lymph nodes</td>
<td>(-)</td>
<td>157</td>
<td>18</td>
</tr>
<tr>
<td>(+)</td>
<td>143</td>
<td>145</td>
<td>18</td>
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<td>Histological grading</td>
<td>G1~G2</td>
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<td>17</td>
</tr>
<tr>
<td>G3~G4</td>
<td>50</td>
<td>54</td>
<td>14</td>
</tr>
<tr>
<td>Lymph node dissection</td>
<td>D0~D1</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>D2~</td>
<td>145</td>
<td>149</td>
<td>25</td>
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<tr>
<td>Tumour size(mm)</td>
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<td>82</td>
<td>4</td>
</tr>
<tr>
<td>21~</td>
<td>97</td>
<td>101</td>
<td>27</td>
</tr>
<tr>
<td>Duodenum passage</td>
<td>(-)</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>(+)</td>
<td>155</td>
<td>157</td>
<td>7</td>
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<tr>
<td>Alive</td>
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<td>133</td>
<td>14</td>
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<td>Cause of death</td>
<td>Primary cancer</td>
<td>9</td>
<td>10</td>
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<td>other cancer</td>
<td>6</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>other disease</td>
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<td>19</td>
<td>3</td>
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<td>Hospital death</td>
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<tr>
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<td>1</td>
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from an anastomotic recurrence. No patient underwent re-resection of the adenocarcinoma of the remaining stomach during this period.

Figure 1 shows the survival curves of patients whose tumors were located in the lower part of the stomach; these patients underwent total or distal gastrectomy. The 10-year survival rates of patients with TG or DG were 16.7% and 68.7%, respectively. There was a significant difference between these two groups (log rank test; TG versus DG, \( p < 0.00001 \)). Figure 2 shows the survival curves of patients whose tumors were located in the middle part of the stomach and who underwent total, distal, or proximal gastrectomy. The 10-year survival rates of patients with TG, DG, or PG were 39.1% and 80.5%, 100%, respectively. There were significant differences among these rates (TG versus DG, log rank test, \( p < 0.00001 \), TG versus PG, \( p = 0.0307 \)). Figure 3 shows the survival curves of

<table>
<thead>
<tr>
<th>Variable</th>
<th>Antrum and pylorus</th>
<th>Corpus</th>
<th>Fundus and Cardia</th>
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<tr>
<td></td>
<td>10-yr (%)</td>
<td>Sig*</td>
<td>10-yr (%)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>64.5</td>
<td>NS</td>
<td>70.0</td>
</tr>
<tr>
<td>Male</td>
<td>68.3</td>
<td></td>
<td>75.5</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>~59</td>
<td>89.2</td>
<td>&lt;0.00001</td>
<td>83.0</td>
</tr>
<tr>
<td>60~</td>
<td>49.3</td>
<td></td>
<td>61.5</td>
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<td>Residual tumour</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>P0</td>
<td>7.7</td>
<td>&lt;0.00001</td>
<td>7.7</td>
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<td>R1-2</td>
<td>71.8</td>
<td></td>
<td>78.8</td>
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<td>Primary tumour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pt1~pt2</td>
<td>70.2</td>
<td>&lt;0.00001</td>
<td>80.8</td>
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<td>pt3~pt4</td>
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<td>Regional lymph nodes</td>
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<tr>
<td>n(-)</td>
<td>77.0</td>
<td>&lt;0.00001</td>
<td>82.9</td>
</tr>
<tr>
<td>n(+)</td>
<td>18.8</td>
<td></td>
<td>18.3</td>
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<td>Extent of resection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16.7</td>
<td>&lt;0.00001</td>
<td>39.1</td>
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<tr>
<td>Partial</td>
<td>68.9</td>
<td></td>
<td>81.0</td>
</tr>
<tr>
<td>Lymph node dissection</td>
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<tr>
<td>D0-D1</td>
<td>20.1</td>
<td>&lt;0.00001</td>
<td>62.5</td>
</tr>
<tr>
<td>D2-</td>
<td>76.4</td>
<td></td>
<td>75.6</td>
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<td>Tumour size (mm)</td>
<td></td>
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<tr>
<td>&gt;20</td>
<td>79.1</td>
<td>0.0044</td>
<td>89.2</td>
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<tr>
<td>(\leq20)</td>
<td>57.2</td>
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<td>62.8</td>
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<td>Histological grading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1~G2</td>
<td>66.2</td>
<td>NS</td>
<td>76.4</td>
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<tr>
<td>G3~G4</td>
<td>67.6</td>
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<td>71.6</td>
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a: log rank test
<table>
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<th>Fundus and Cardia</th>
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<tr>
<td></td>
<td>Sig Lower Upper</td>
<td>Sig Lower Upper</td>
<td>Sig Lower Upper</td>
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<td>Primary tumour</td>
<td>0.0000 0.0586 0.2619</td>
<td>0.0000 0.0315 0.1213</td>
<td>0.0143 0.0904 0.7658</td>
</tr>
<tr>
<td>(pt1-p2 vs pt3-p4)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Regional lymph nodes (-) vs (+)</td>
<td>0.0000 0.0680 0.2243</td>
<td>0.0000 0.0536 0.1802</td>
<td>0.0001 0.0015 0.1062</td>
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<td>Extent of resection Total vs Partial</td>
<td>0.0000 0.1185 0.4003</td>
<td>0.0000 0.1185 0.4003</td>
<td>0.0047 0.0446 0.5685</td>
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<tr>
<td>Lymph node dissection D0-D1 vs D2-</td>
<td>0.0000 2.6860 8.7970</td>
<td>0.0151 1.1923 5.1676</td>
<td>0.0311 1.1070 8.5199</td>
</tr>
<tr>
<td>Tumour size (mm) <del>20 vs 20</del></td>
<td>0.0058 0.2137 0.7703</td>
<td>0.0011 0.1414 0.6129</td>
<td>0.0037 0.0418 0.5413</td>
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<tr>
<td>Age <del>59 vs 60</del></td>
<td>0.0000 0.0627 0.3495</td>
<td>0.0012 0.1929 0.6670</td>
<td>NS 0.1390 1.3280</td>
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<tr>
<td>Histological grading G1-G2 vs G3-G4</td>
<td>NS 0.5605 2.0192</td>
<td>NS 0.4204 1.3877</td>
<td>NS 0.2560 3.2630</td>
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<td>Sex F vs M</td>
<td>NS 0.6219 2.2381</td>
<td>NS 0.7310 2.5463</td>
<td>NS 0.1985 3.8732</td>
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# TABLE IV
Results of Cox’ multivariate analysis of patients according to 6 covariates

<table>
<thead>
<tr>
<th>Variable</th>
<th>95% CI for Exp.</th>
<th>Sig</th>
<th>Lower</th>
<th>Upper</th>
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</thead>
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<tr>
<td>Age</td>
<td>0.0000</td>
<td>0.2039</td>
<td>0.5202</td>
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<tr>
<td>Primary tumour pt1–pt2 vs pt3–pt4</td>
<td>0.0000</td>
<td>0.1668</td>
<td>0.4651</td>
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<tr>
<td>Regional lymph nodes (-) vs (+)</td>
<td>0.0000</td>
<td>0.1447</td>
<td>0.3707</td>
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</tr>
<tr>
<td>Lymph node dissection D0–D1 vs D2−</td>
<td>0.0021</td>
<td>1.2856</td>
<td>3.0994</td>
<td></td>
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<tr>
<td>Extent of resection Total vs Partial</td>
<td>0.0324</td>
<td>0.3913</td>
<td>0.9598</td>
<td></td>
</tr>
<tr>
<td>Tumour size (mm) <del>20 vs 20</del></td>
<td>0.0467</td>
<td>0.3712</td>
<td>0.9928</td>
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# TABLE V
Results of Cox’ multivariate analysis of patients whose tumors were located in the lower part of the stomach

<table>
<thead>
<tr>
<th>Variable</th>
<th>95% CI for Exp.</th>
<th>Sig</th>
<th>Lower</th>
<th>Upper</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.0002</td>
<td>0.0684</td>
<td>0.4269</td>
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<tr>
<td>Primary tumour pt1–pt2 vs pt3–pt4</td>
<td>0.0011</td>
<td>0.1422</td>
<td>0.6144</td>
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<td>Lymph node dissection D0–D1 vs D2−</td>
<td>0.0027</td>
<td>1.4082</td>
<td>5.1446</td>
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<tr>
<td>Regional lymph nodes (-) vs (+)</td>
<td>0.0050</td>
<td>0.0948</td>
<td>0.6577</td>
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<tr>
<td>Extent of resection Total vs Partial</td>
<td>0.0355</td>
<td>0.1171</td>
<td>0.9273</td>
<td></td>
</tr>
<tr>
<td>Tumour size (mm) <del>20 vs 20</del></td>
<td>0.3689</td>
<td>0.3512</td>
<td>1.4748</td>
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# TABLE VI
Results of Cox’ multivariate analysis of patients whose tumors were located in the middle part of the stomach

<table>
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<tr>
<th>Variable</th>
<th>95% CI for Exp.</th>
<th>Sig</th>
<th>Lower</th>
<th>Upper</th>
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</thead>
<tbody>
<tr>
<td>Regional lymph nodes (-) vs (+)</td>
<td>0.0000</td>
<td>0.0742</td>
<td>0.3555</td>
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<tr>
<td>Primary tumour pt1–pt2 vs pt3–pt4</td>
<td>0.0013</td>
<td>0.1126</td>
<td>0.5904</td>
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<tr>
<td>Age</td>
<td>0.0045</td>
<td>0.2033</td>
<td>0.7465</td>
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<tr>
<td>Tumour size (mm) <del>20 vs 20</del></td>
<td>0.0990</td>
<td>0.2249</td>
<td>1.1367</td>
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<tr>
<td>Lymph node dissection D0–D1 vs D2−</td>
<td>0.1484</td>
<td>0.8095</td>
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<tr>
<td>Extent of resection Total vs Partial</td>
<td>0.5280</td>
<td>0.3577</td>
<td>1.6943</td>
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# TABLE VII
Results of Cox’ multivariate analysis of patients whose tumors were located in the upper part of the stomach

<table>
<thead>
<tr>
<th>Variable</th>
<th>95% CI for Exp.</th>
<th>Sig</th>
<th>Lower</th>
<th>Upper</th>
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<tr>
<td>Primary tumour pt1–pt2 vs pt3–pt4</td>
<td>0.0008</td>
<td>0.0022</td>
<td>0.1992</td>
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<td>Lymph node dissection D0–D1 vs D2−</td>
<td>0.1336</td>
<td>0.7529</td>
<td>8.4517</td>
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<tr>
<td>Tumour size (mm) <del>20 vs 20</del></td>
<td>0.1920</td>
<td>0.0791</td>
<td>1.6642</td>
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</tr>
<tr>
<td>Extent of resection Total vs Partial</td>
<td>0.2291</td>
<td>0.0889</td>
<td>1.7851</td>
<td></td>
</tr>
<tr>
<td>Regional lymph nodes (-) vs (+)</td>
<td>0.7434</td>
<td>0.2071</td>
<td>3.0770</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.9383</td>
<td>0.2801</td>
<td>3.2405</td>
<td></td>
</tr>
</tbody>
</table>
patients whose tumors were located in the upper part of the stomach and who underwent total or proximal gastrectomy. The 10-year survival rates of patients with TG or PG were 30.6% and 66.6%, respectively. There was a significant difference between these groups (log rank test, \( p=0.0014 \)).

Table II shows the 10-year survival rates of patients as regards tumor localization. The following factors were associated with a shorter survival time: lymph node involvement, age > 60, high \( pT \), total gastrectomy, larger tumor size, and lower lymph node dissection.

Table III shows the results of the Cox univariate analysis. Regional lymph node metastasis, age, depth of primary tumor invasion, lymph node dissection, extent of resection, and tumor size were significant variables related to survival; however sex and histological grading were not significant variables related to survival.

Table IV shows the results of the Cox multivariate analysis of variables examined in 442 patients. This multivariate analysis was used to evaluate the six variables shown to be significant on univariate analysis. Regional lymph nodes metastasis, age, depth of primary tumor invasion, lymph node dissection, extent of resection, and tumor size were significant independent prognostic variables.

Table V shows the results of multivariate analysis in patients whose tumors were located in the lower part of the stomach. Regional lymph node metastasis, age, depth of primary tumor invasion, lymph node dissection, and extent of resection were significant prognostic variables, tumor size was not a significant variable.

Table VI shows the results of multivariate analysis in patients whose tumors were located in the middle part of the stomach. Regional lymph node metastasis, age, and depth of primary tumor invasion were significant prognostic variables. however, lymph node dissection, extent of resection, and tumor size were not significant.

Table VII shows the results of a multivariate analysis of patients whose tumors were located in the upper part of the stomach. Primary tumor was a significant prognostic variable, but regional lymph node metastasis, age, tumor size, lymph node dissection, and extent of resection were not significant.

Figure 4 shows the changes in CD4 T-cell populations in patients who received a total or (distal or proximal) subtotal gastrectomy. There was no significant difference between the two groups. However, there was a significant difference between the total and
subtotal gastrectomy group in the CD8 T-cell population at 6 months after surgery (p=0.028; Figure 5). The CD8 T-cell population gradually increased after total gastrectomy.

Figures 6 shows changes in the CD4/8 ratio in patients who received total or subtotal gastrectomy. Significant differences were noted between the total and subtotal gastrectomy groups (p=0.005 and p=0.047 at 3 and 6 months, respectively).

Discussion

It was demonstrated that subtotal gastrectomy is indicated for the treatment of gastric cancer, and that in many cases, it is preferred. The choice between total gastrectomy or subtotal gastrectomy for adenocarcinoma of the stomach has not yet been well-established. In the present study, the extent of gastric resection depended on the tumor localization. Distal subtotal gastrectomies were performed when tumors were located in the lower third of the stomach, and proximal subtotal gastrectomies were considered when tumors were located in the upper third of the stomach and when a safe proximal or distal resection margin was guaranteed. Total gastrectomies were performed when tumors invaded to the entire stomach and were multifocal.

To broaden the criteria for choice of treatment for gastric cancer, we determined the impact of various gastrectomy procedures on survival during a 10-yr follow-up period; we also considered immunological postoperative changes. Our data showed that the 10-year survival rates of patients who received proximal or distal subtotal gastrectomy were significantly better than those patients who received total gastrectomy. There was a significant difference between patients with the CD4+/CD8+ ratio who received total gastrectomy and those who received subtotal gastrectomy at 3-6 postoperative months. Similar results have been reported by Tsuburaya (Tsuburaya, Noguchi et al., 1993). A Cox multivariate analysis also revealed that operative procedure was a significantly related covariate to patient prognosis. However, the advantages of TG have been repeatedly described in the literature. Due to the complete removal of the stomach with the lymph nodes, TG did not improve survival, according to the present study.

The French Association for surgical research and the Norwegian Stomach Cancer Trial, which have conducted prospective controlled research (Gouzi, Huguier et al., 1988;
Haugstvedt, Viste et al., 1993), failed to demonstrate that the extent of gastric resection was a significant predictor of long-term survival. However, several retrospective studies (Gennari, Bozzetti et al., 1986; Robertson, Chung et al., 1994) demonstrated that DG offered a significantly better survival rate than TG. There has not been a report comparing the three surgical procedures (i.e., TG, PG, and DG) as regards tumor localization and impact on long-term outcome.

The present data suggest that TG may have detrimental immunological effects that eventually lead to a poor outcome. The data further more suggest that the extent of resection is a significant survival factor as regards treatment choice in cases of gastric cancer, since patients who underwent DG or PG had a persistently better immunological status and consequently a better outcome than those who underwent TG. Moreover, Davies, Johnston et al., (1998) and Jentchura, Winkler et al., (1997) reported that at 1 year after surgery, patients who underwent DG also had a significantly better quality of life than patients who underwent TG. The QOL of patients who underwent subtotal gastrectomy was also significantly better after surgery than it had been before the operation, whereas the QOL of the total gastrectomy group was not significantly better after the operation than before.

In conclusion, to optimize the benefits of gastrectomy, the area of resection of the stomach must be taken into consideration. When subtotal distal or proximal gastrectomy is clinically feasible, this procedure has advantages in the early postoperative period at 3 to 6 months after gastrectomy, with respect to immunological assessment; this suggests a better chance of long-term survival. If the surgical margin is free of cancer, it is useful to avoid total resection of the stomach; this maintains immune status, facilitates recovery, and/or maintains immunological competence after resection of the stomach. Assuming that the types of gastrectomy affect the prognosis of cancer patients, the extent of surgical resection must be considered as an important factor in formulating a treatment plan for adenocarcinoma of the stomach.

References


