

End results of simultaneous pancreatectomy, splenectomy and total gastrectomy for patients with gastric carcinoma

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Summary A distal pancreatectomy is often performed simultaneously with splenectomy and total gastrectomy in the treatment of gastric carcinoma to facilitate dissection of the lymph nodes around the splenic artery. However, the morbidity of partial pancreatectomy is high. Patients undergoing pancreaticosplenectomy in conjunction with total gastrectomy are subject to leaks from the pancreatic stump, which may cause further complications. We performed a retrospective analysis to evaluate the end results of simultaneous distal pancreatectomy with total gastrectomy. The effect of distal pancreatectomy on survival was studied by examination of the records of 174 patients who underwent splenectomy and total gastrectomy for gastric carcinoma. Of these, 93 underwent distal pancreatectomy. Prognostic factors were determined and were examined in relation to the post-operative complications. There was no significant difference in the 5-year survival of the patients who did or did not undergo distal pancreatectomy. There was no correlation between any prognostic factor and distal pancreatectomy. In contrast, distal pancreatectomy was independently associated with post-operative complications. In this retrospective study, the addition of distal pancreatectomy to splenectomy at total gastrectomy for patients with gastric cancer did not affect survival but was associated with severe complications.

Keywords: gastric carcinoma; total gastrectomy; distal pancreatectomy

The means of improving life expectancy in patients with gastric cancer are early diagnosis and adequate surgical intervention. Recently, in the treatment of carcinoma of the stomach, aggressive lymph node dissection in conjunction with gastrectomy has been reported to result in substantial improvements in survival (Maruyama et al, 1987; Shiu et al, 1987). Distal pancreatectomy is often performed simultaneously with total gastrectomy to facilitate dissection of the lymph nodes around the splenic artery. There have been reports in which distal pancreatectomy and splenectomy resulted in better survival than splenectomy alone in gastric cancer patients who underwent total gastrectomy (Nishioka et al, 1979; Takagi et al, 1980).

However, the morbidity of a partial pancreatectomy is high (Maruyama, 1979). Several investigators have demonstrated that patients undergoing pancreaticosplenectomy in conjunction with total gastrectomy are subject to leaks from the stump of the pancreas (Cuschieri et al, 1996). This predisposes to subphrenic abscess formation, dehiscence of visceral anastomoses and erosion of blood vessels in the area of the pancreas, resulting in high peri-operative mortality rates. Thus, there is no consensus of opinion regarding the therapeutic value of simultaneous distal pancreatectomy in patients undergoing splenectomy with total gastrectomy for gastric carcinoma.

We performed a retrospective analysis of 174 patients who underwent splenectomy with total gastrectomy for gastric carcinoma to evaluate the effect of distal pancreatectomy on survival.

The post-operative morbidity in the patients who had a distal pancreatectomy in conjunction with a total gastrectomy and splenectomy was compared with the morbidity in the patients who had undergone only a splenectomy at the time of the total gastrectomy.

PATIENTS AND METHODS

Patients

From 1983 to 1994, 268 patients underwent total gastrectomy for gastric carcinoma by staff members of the First Department of Surgery, Kyoto Prefectural University of Medicine, Japan. Of these patients, 93 (35%) underwent both splenectomy and distal pancreatectomy with total gastrectomy, 81 (30%) underwent splenectomy in conjunction with total gastrectomy and 94 (35%) underwent only total gastrectomy. In this series, comparison was made between 93 with pancreaticosplenectomy and 81 with splenectomy alone.

Surgical technique

The surgical procedures were performed by several attending surgeons on the faculty or by surgical fellows under their supervision. Patients with gastric carcinoma located in the middle or proximal portion of the stomach underwent total gastrectomy using the same technique. The tumours were graded using the UICC classification of malignant tumours (4th edition) (Hermanek et al, 1987).

Clinicopathological findings

Information collected from the medical records included the age and sex of the patient, as well as the size and histological grade of

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Table 1 Clinicopathological findings in the patients who underwent splenectomy and total gastrectomy with or without distal pancreatectomy

Variables	Without distal pancreatectomy (n = 81)	With distal pancreatectomy (n = 93)	P-value
Age (year, mean)	59.4	57.5	NS
Sex (female/male)	48/33	59/34	NS
Tumour size (mm, mean)	70.5	85.2	NS
Primary tumour (pT1/pT2/pT3/pT4)	7/32/35/7	1/29/41/22	< 0.05*
Location (upper/middle/lower/whole)	43/20/4/14	43/26/2/22	NS
Regional lymph nodes (positive/negative)	36/45	34/59	NS
Distant metastasis (M0/M1)	60/21	53/40	< 0.05*
UICC staging (Ia/Ib/II/IIIa/IIIb/IV)	6/19/13/14/13/16	1/10/10/16/13/43	< 0.05*
Residual tumour (R0/R1/R2)	63/4/14	53/8/32	< 0.05*
Operative time (min, mean)	290	322	< 0.05*
Preoperative co-morbidity (positive/negative)	21/60	27/56	NS
Post-operative co-morbidity (positive/negative)	50/31	43/50	< 0.05*
Blood transfusion (positive/negative)	48/33	63/30	NS

NS, not significant. *Significant difference.

Table 2 Univariate analysis of prognostic variables for survival

Variables	P-value
Age (over or under 65 years old)	0.791231
Sex (female/male)	0.381712
Tumour size (more or less than 5 cm)	0.008643*
Primary tumour (pT1/pT2/pT3/pT4)	0.000129*
Location (upper/middle/lower/whole)	0.010572*
Regional lymph nodes (N0/N1/N2)	0.000023*
Distant metastasis (M0/M1)	0.000015*
Residual tumour (R0/R1/R2)	0.000006*
Operative time (more or less than 300 min)	0.422604
Preoperative co-morbidity (positive/negative)	0.419974
Blood transfusion (positive/negative)	0.519431

*Significant difference.

Table 3 Multivariate analysis of prognostic variables for survival

Variables	Regression coefficient	P-value
Tumour size	0.10024	0.31767
Cancer stage	0.63761	0.00025*
Location	0.08723	0.38813
Residual tumour	0.25584	0.05578
Distal pancreatectomy	0.04743	0.67422

*Significant difference.

the primary tumour, the depth of invasion and whether there were regional lymph node or distant metastases. The UICC stage, whether or not there was residual tumour, the operative time, preoperative co-morbid conditions and blood transfusion requirements were also recorded.

Post-operative complications were reviewed. A complication was not considered infectious unless confirmed by bacteriological cultures.

Statistical methods

Statistical analysis was performed using the NAP system (Version 4.0) (Aoki, 1989). The first objective of the statistical analysis was to examine the influence of each clinical, pathological and

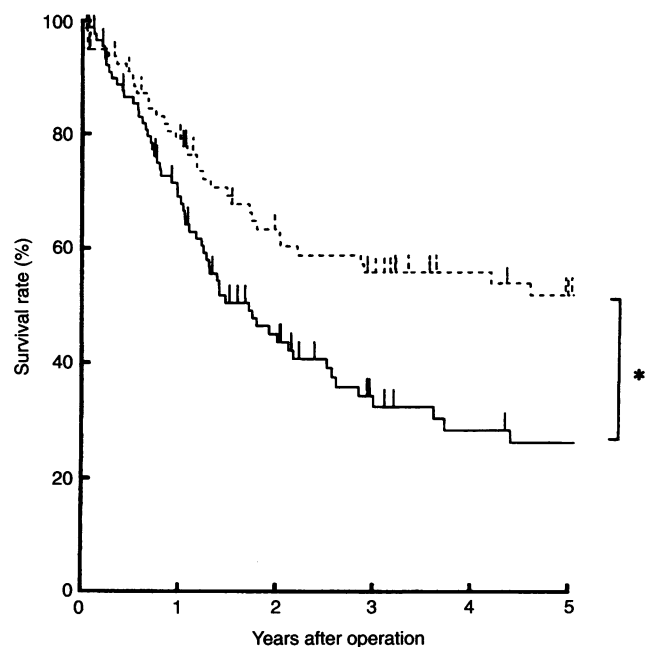


Figure 1 The 5-year survival rates for the patients who underwent total gastrectomy and splenectomy with or without distal pancreatectomy. Using the generalized Wilcoxon test, a significant difference is observed between the post-operative survival rates for the patients who underwent total gastrectomy with or without distal pancreatectomy. —, with distal pancreatectomy (n = 93); - - -, without distal pancreatectomy (n = 81). *Significant difference

treatment variable on survival following total gastrectomy. Information obtained from the univariate analysis (log-rank test) was applied to a survival analysis with covariates using the Cox model of proportional hazards (Cox, 1972). To analyse the influence of distal pancreatectomy on survival following gastrectomy, the Kaplan-Meier method and generalized Wilcoxon test were performed.

The second objective of the statistical analysis was to assess the dependence of the complications. Univariate analysis using the Student's *t*-test and the chi-square test was performed to assess the dependency of the post-operative complications on 12 explanatory variables.

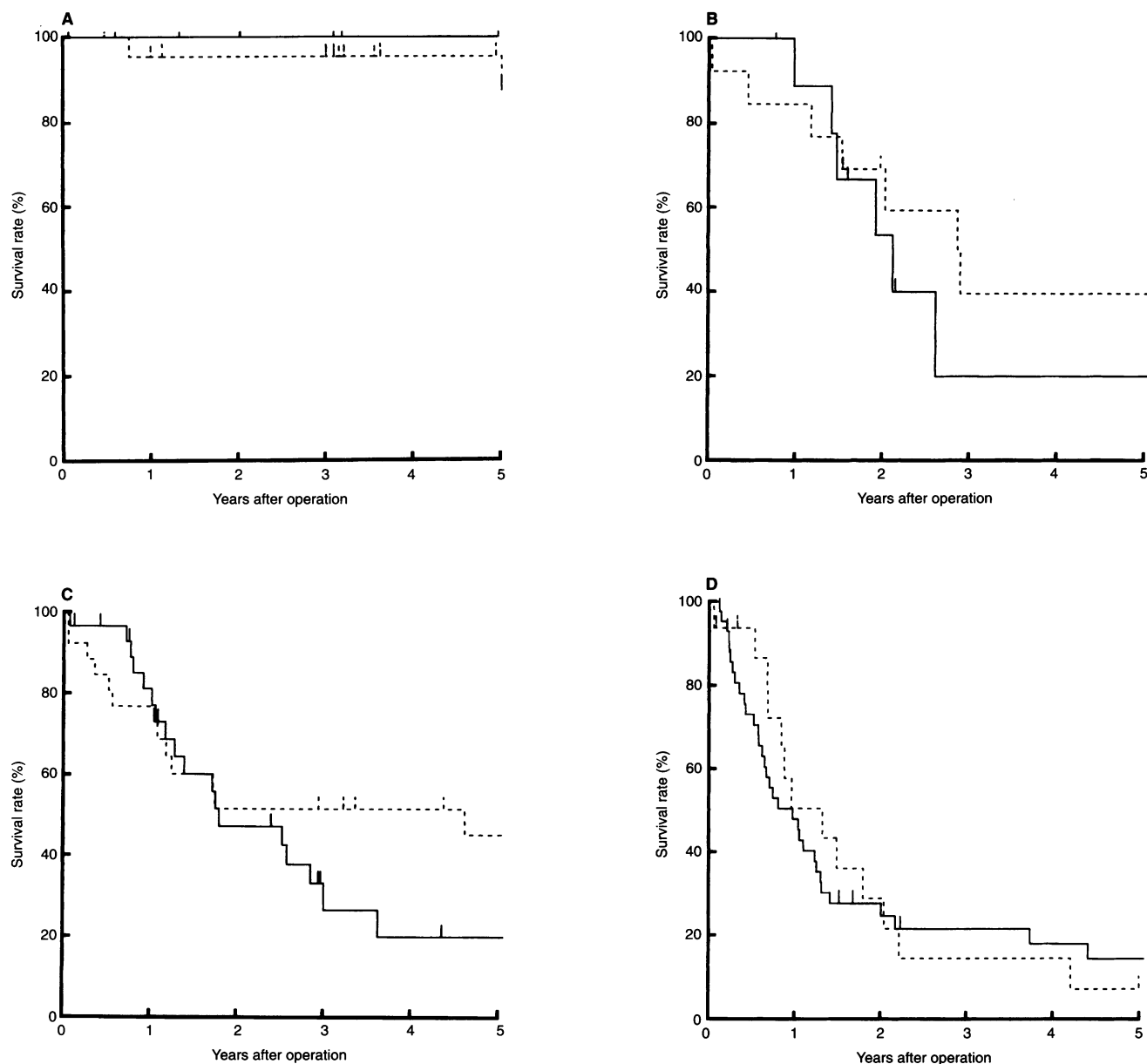


Figure 2 The 5-year survival rates for the patients who underwent total gastrectomy and splenectomy with or without distal pancreatectomy at each cancer stage (A, stage I; B, stage II; C, stage III; D, stage IV). There are no significant differences between the post-operative survival rates for the patients who underwent total gastrectomy with or without distal pancreatectomy using the generalized Wilcoxon test. —, with distal pancreatectomy [(A) $n = 11$, (B) $n = 10$, (C) $n = 29$, (D) $n = 43$]; - - -, without distal pancreatectomy [(A) $n = 25$, (B) $n = 13$, (C) $n = 27$, (D) $n = 16$]

RESULTS

Clinicopathological findings

Significant differences were noted in the size of the primary tumour, the prevalence of distant metastases and residual tumour, the tumour stage, the operative time and the post-operative co-morbidity between the patients who had and those who had not undergone distal pancreatectomy (Table 1).

Prognostic factors

Of the 11 clinical and pathological variables identified by univariate analysis, six were found to be independently predictive of survival

and were selected for the final proportional hazards regression. Those variables were tumour size, depth of cancer invasion, location of the primary tumour and the presence of regional lymph node metastases, distant metastases or residual tumour (Table 2). Multivariate analysis showed that the only significant prognostic factor for the patients with gastric carcinoma who underwent total gastrectomy was cancer stage. Whether or not distal pancreatectomy was performed was not an independent prognostic factor (Table 3).

Survival rates

The cumulative 5-year survival of the patients who underwent total gastrectomy with or without distal pancreatectomy was 26%

Table 4 Post-operative complications following total gastrectomy

Complication	Without distal pancreatectomy	With distal pancreatectomy	P-value
Cardiac	3 (3.7)	3 (3.2)	NS
Pulmonary	4 (4.9)	4 (4.3)	NS
Liver dysfunction	4 (4.9)	9 (9.6)	NS
Renal dysfunction	1 (1.2)	2 (2.1)	NS
Bleeding	1 (1.2)	2 (2.1)	NS
Anastomotic leakage	10 (12.3)	14 (14.5)	NS
Intestinal obstruction	4 (4.9)	3 (3.2)	NS
Pancreatitis	1 (1.2)	2 (2.1)	NS
Pancreatic fistula	2 (2.5)	11 (11.7)	0.01918*
Wound infection	5 (6.2)	7 (7.4)	NS

Numbers in parentheses are percentages.
NS, not significant. *Significant difference.

and 51% respectively. Using the generalized Wilcoxon test, a significant difference was observed between the post-operative survival rates for the patients who underwent total gastrectomy with or without distal pancreatectomy ($P = 0.02368$) (Figure 1). Because cancer stage was an independent prognostic factor, and because there was a significant difference in the number of patients classified at each stage, post-operative survival analysis was performed according to cancer stage. The cumulative 5-year survivals for the patients who underwent total gastrectomy with distal pancreatectomy were 100%, 20%, 20% and 14% for stages I, II, III and IV respectively. In contrast, the cumulative 5-year survivals for the patients who did not undergo distal pancreatectomy were 95%, 39%, 45% and 7% for stages I, II, III and IV respectively. There were no significant differences between the post-operative survival rates at each stage for the patients who underwent total gastrectomy with or without distal pancreatectomy ($P = 0.34291, 0.57208, 0.95854$ and 0.49118 respectively) (Figure 2).

Complication following total gastrectomy

Pancreatic fistulae were significantly more common following total gastrectomy with distal pancreatectomy than after gastrectomy without distal pancreatectomy (Table 4). To assess the dependency of these variables, univariate analysis was performed which revealed that the presence of residual tumour and the performance of a distal pancreatectomy significantly affected the incidence of post-operative complications (Table 5).

DISCUSSION

The extent of the lymph node dissection performed with a gastrectomy for gastric carcinoma has been the topic of much discussion (Soga et al, 1979, 1988; Gall et al, 1985). Pancreaticosplenectomy was first performed by Brunschwig (1948) and McNeer et al (1948) and Kajitani (Kajitani et al, 1964) in 1949 to dissect the lymph nodes around the splenic hilum and splenic artery and was advocated as the standard procedure for proximal gastric cancer by Nakayama (1956) and Suzaki (1954). Because the lymphatics along the splenic artery lie in the wall of the bursa, the lymph nodes along the splenic artery can be completely dissected if excision of the splenorenal ligament, dissection between Toldt's fascia and the renal fascia and pancreaticosplenectomy are

Table 5 Univariate analysis of post-operative complications

Risk factor	P-value	Statistical method
Age	0.33410	t-test
Sex	0.71021	χ^2 test
Tumour size	0.60444	t-test
Primary tumour	0.33261	χ^2 test
Location	0.29180	χ^2 test
Lymph node metastasis	0.80449	χ^2 test
Cancer stage	0.36250	χ^2 test
Residual tumour	0.03465*	χ^2 test
Operative time	0.13293	t-test
Preoperative co-morbidity	0.17097	χ^2 test
Blood transfusion	0.46169	χ^2 test
Distal pancreatectomy	0.04100*	χ^2 test

*Significant difference.

performed (Hirayama et al, 1979). Maruyama et al (1987) have recently reported a new procedure for complete dissection of the lymph nodes around the splenic artery without sacrificing the pancreas. However, Kanai (1967) has demonstrated, by examining sequential sections of the distal pancreas and surrounding tissues, that remnant nodes exist along the splenic artery in 74.7% of patients. This suggests that organ resection in the absence of true invasion is necessary to ensure the completeness of nodal dissection. Other authors have also demonstrated a discrepancy between the macroscopic and microscopic involvement of the lymph nodes along the splenic artery (Wada et al, 1970; Kawata et al, 1975). Thus, distal pancreaticosplenectomy with total gastrectomy has been widely performed as the standard procedure for the treatment of proximal gastric cancer.

Kawaguchi et al (1983) have reported that nodal metastases around the splenic artery are associated with nodal metastasis at other sites. Sugimachi et al (1982) have reported that 85.4% of the patients with nodal metastases at the splenic hilum or around the splenic artery are incurable with surgery because of factors other than the existence of these nodal metastases. In this study, the effect of distal pancreatectomy was examined on the outcome of patients undergoing total gastrectomy for gastric carcinoma. We found no significant difference in post-operative survival in the patients who had undergone total gastrectomy with or without distal pancreatectomy.

The morbidity in patients who have undergone both a splenectomy and a distal pancreatectomy with a total gastrectomy has been reported to be greater than that in the patients who have undergone splenectomy and gastrectomy alone (Lundell et al, 1986; Fortner et al, 1994). In the present study, significantly more pancreatic fistulae were observed in the patients who had undergone distal pancreaticosplenectomy. Pancreatic fistulae are caused by extravasation of pancreatic fluid secreted by the remnant gland. Although some investigators have reported the new method of segmental occlusion of the pancreatic duct with prolamine to prevent pancreatic fistula development following distal pancreatectomy (Konishi et al, 1995), this procedure has not been widely used clinically. In our study, stepwise logistic regression analysis revealed that distal pancreatectomy independently correlates with post-operative complications.

These results illustrate that the addition of distal pancreatectomy to total gastrectomy and splenectomy for gastric cancer does not improve survival but is associated with severe complications.

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