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Original article

Risk factors for pancreas-related abscess after total gastrectomy

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Abstract

Background. **European clinical trials of gastrectomy have shown that pancreas-related complications are the major cause of mortality. The aim of this study was to determine the risk factors for pancreas-related abscess after gastrectomy and to evaluate the effects of the abscess on postoperative mortality.**

Methods. **Between 1992 and 1999, 663 consecutive patients with gastric carcinoma underwent total gastrectomy. Data from these patients were analyzed, to identify the predictors of pancreas-related abscess caused by pancreatic juice leakage, by a multiple logistic regression model.**

Results. **On multivariate analysis, increasing age ($P = 0.018$) and body mass index ($P = 0.006$) were independent preoperative risk factors. Dissection along the distal splenic artery was an intraoperative risk factor. The hazard ratios were increased 9.13-fold ($P = 0.000$) with a pancreas-preserving operation and 16.72-fold ($P = 0.000$) by distal pancreatectomy. Patients with the abscess had a higher postoperative mortality rate ($P = 0.008$), and a higher re-operation rate ($P < 0.001$) than patients without the abscess.**

Conclusion. **Pancreas-related abscess is more likely to occur in older, obese patients undergoing node dissection along the distal splenic artery. Abscess formation is associated with a higher mortality and re-operation rate. Spleen preservation should be evaluated in Japan.**

Key words Gastric cancer · Morbidity

Introduction

The most frequent major complication after gastrectomy with extended dissection is pancreatic juice leakage [1], because recently, the incidence of anastomotic leakage has decreased remarkably [2]. Pancreatic juice leakage is often followed by contamination, resulting in a peripancreatic abscess. Secondary hemorrhage from major arteries damaged by contamination can be fatal. European clinical trials of gastrectomy have shown that pancreas-related complications are a major cause of mortality [3,4].

The prediction and early detection of pancreas-related complications may be helpful. The aim of this study was to determine risk factors for pancreas-related abscess after gastrectomy, caused by pancreatic juice leakage, and to evaluate the effects of the abscess on postoperative mortality.

Patients and methods

Six hundred and sixty-three consecutive patients with gastric carcinoma underwent total gastrectomy, between 1992 and 1999, at the National Cancer Center Hospital, Tokyo. Data for these patients were analyzed to identify the predictors of pancreas-related abscess caused by pancreatic juice leakage, using a multivariate logistic regression model.

The diagnosis of a pancreas-related abscess was made when purulent fluid containing turbid necrotic debris drained from the peripancreatic area for more than 7 days. The abscess cavity was assessed by computed tomography (CT) scan and contrast study through drains. We recorded an abscess regardless of its cavity size. When we found anastomotic leakage radiologically on initial diagnosis of the abscess, we excluded these patients from the pancreas-related abscess group.

The preoperative and perioperative data were collected from the patients' records and stored on our gastric surgical database.

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Operative techniques

Total gastrectomy with Roux-en-Y esophagojejunostomy was performed in 623 patients (94.0%), as the standard operation. Forty patients (6.0%) underwent jejunal interposition. Pouch formations were added in 7 patients (1.1%). The extent of nodal dissection along the distal splenic artery and splenic hilum varied, including no dissection of these nodes. Distal pancreatectomy or the Maruyama pancreas-preserving method [5] was usually performed for advanced tumor (T2, T3, and T4). The splenic arteries were sacrificed distally to the dorsal pancreatic arteries, in all patients, when we performed pancreas-preserving total gastrectomy. At least one drainage tube was applied in the left subphrenic space in all patients. In most cases, the amylase level of the drainage fluid was determined on the first postoperative day. All patients received antibiotic prophylaxis for the same period.

Statistical methods

Univariate analyses were performed in order to predict those preoperative and perioperative variables that were associated with a pancreas-related abscess. Fischer's exact test and the Mann-Whitney test were used as appropriate.

To develop a model for predicting postoperative pancreas-related abscess in terms of pre- and perioperative variables, three preoperative and six perioperative variables were entered in multiple logistic regression analysis. All the statistical procedures were performed with the SPSS 11.5 statistical package (SPSS Japan, Tokyo, Japan). The limit for statistical significance was $P < 0.05$.

Results

The overall incidence of pancreas-related abscess was 11.5%. The median amylase level of the drainage fluid on the first postoperative day was 1942 I/l (range, 22–387 000) U/l overall, and it was 1682 (22–303 800) U/l in patients without abscess and 6590 (96–387 000) U/l in patients with abscess.

The male-to-female ratio was 2.5:1, and the mean age was 59.9 ± 11.6 years. The proportion of patients with early gastric cancer (T1) was 21.1%. Operation with curative intent was performed in 82.5% of the patients. Nodal dissection along the distal splenic artery was performed in 68.0% of the patients and D2 dissection or more was carried out in 67.6 % of the patients. The median operation time was 263 min (90–580 min). Median blood loss was 567 ml (250–4457 ml).

Univariate analysis identified several preoperative patient-related factors as having a high association with pancreas-related abscess. The preoperative demographic data are shown in Table 1, for patients with and without the abscess. Increasing age ($P = 0.004$) and increasing body mass index ($P = 0.008$) had a strong association with postoperative pancreas-related abscess.

Perioperative data are also presented in Table 1. Univariate analysis showed that depth of tumor invasion ($P = 0.007$), operation time ($P = 0.024$), extent of dissection ($P = 0.000$), and dissection along the distal splenic artery ($P = 0.000$) were all associated with a greater incidence of abscess formation. The method of dissection along the distal splenic artery was categorized into one of five variations.

Multivariate analysis identified three independent factors as predictors of postoperative pancreas-related abscess formation (Table 2). Increasing age and increasing body mass index increased the risk of the abscess by 1.4- and 1.1-fold, respectively.

Dissection of nodes along the distal splenic artery and in the splenic hilum was an intraoperative risk factor. If the relative risk for the abscess was set at 1 for patients with neither splenectomy nor pancreatectomy, the hazard ratios were 9.1 for pancreas-preserving operation and 16.7 for distal pancreatectomy.

The postoperative outcomes of the patients with and without pancreas-related abscess were compared (Table 3). The patients with the abscess had a higher postoperative mortality rate. Patients with pancreas-related abscess had 7.6-fold increased mortality compared to patients without the abscess. The re-operation rate for patients with pancreas-related abscess was 32-fold greater than that for patients without the abscess.

Discussion

Increasing body mass index increases the risks of pancreas-related abscess. The literature also reports fat volume as being a risk factor in increasing postoperative complications [6,7]. Nodal dissection along the distal pancreas and in the splenic hilum in obese patients is a difficult task, even in the hands of experienced surgeons specializing in the treatment of gastric carcinoma.

Patients in the West usually have a higher body mass index than those in Japan [8]. The observed high morbidity rates in Western randomized trials for D2 dissection may be related to the greater obesity of these patients.

Increasing age also increases the risk of abscess formation. Patients in the West receiving gastrectomies are usually older than those in Japan, as well as having a

Table 1. Univariate analysis of variables associated with pancreas-related abscess

				No abscess (n = 587)	Abscess (n = 76)	P value; patients with vs without abscess
Preoperative variables						
Sex						
Male				413 (87.1%)	61 (12.9%)	0.080
Female				174 (92.1%)	15 (7.9%)	
Age (years)				59.5 (22–91)[a]	62.8 (44–84)[a]	0.004
Body mass index (kg/m^2)				21.7 (12.2–37.7)[a]	22.6 (15.0–31.5)[a]	0.008
Perioperative variables						
Depth of tumor invasion						
Early (T1)				133 (95.0%)	7 (5.0%)	0.007
Advanced (T2, T3, T4)				454 (86.8%)	69 (13.2%)	
Curability of operation						
Curative (R0)				480 (87.8%)	67 (12.2%)	0.200
Noncurative (R ≧ 1)				107 (92.2%)	9 (7.8%)	
Operation time (min)				260 (90–580)[a]	286 (140–540)[a]	0.024
Blood loss (ml)				565 (25–3776)[a]	587.5 (70–4457)[a]	0.123
Extent of dissection						
D0, D1				207 (96.3%)	8 (3.7%)	0.000
D2, D3				380 (84.8%)	68 (15.2%)	
Dissection methods for nodes along the distal splenic artery						
	Splenectomy	Distal pancreatectomy	Dissection along distal splenic artery			
1.	No	No	No	155 (98.1%)	3 (1.9%)	0.000
2.	Yes	No	No	49 (90.7%)	5 (9.3%)	
3.	No	No	Yes	10 (83.3%)	2 (16.7%)	
4.	Yes	No	Yes	309 (86.3%)	49 (13.7%)	
5.	Yes	Yes	Yes	64 (79.0%)	17 (21.0%)	

Splenectomy (yes), pancreatectomy (no), dissection along distal splenic artery (yes) indicates pancreas-preserving total gastrectomy method
[a]Median values, with ranges in parentheses

Table 2. Multivariate predictors of pancreas-related abscess

Variables				P value	Odds ratio	95% Confidence interval of odds ratio
Preoperative variables						
Age (continuous)				0.018	1.414	1.060–1.886
Body mass index (continuous)				0.006	1.126	1.035–1.225
Perioperative variables						
Dissection methods for nodes along the distal splenic artery						
	Splenectomy	Distal pancreatectomy	Dissection along distal splenic artery			
1.	No	No	No		1	
2.	Yes	No	No	0.012	6.601	1.505–28.953
3.	No	No	Yes	0.011	11.973	1.760–81.468
4.	Yes	No	Yes	0.000	9.130	2.791–29.864
5.	Yes	Yes	Yes	0.000	16.724	4.675–59.823

Table 3. Relationship of postoperative events to pancreas-related abscess

Variables	No abscess ($n = 587$)	Abscess ($n = 76$)	P value
Re-operation	4 (0.7%)	17 (22.4%)	< 0.001
Operation-related death	4 (0.7%)	4 (5.3%)	0.008

higher body mass index [9,10]. The observed high morbidity rates in Western trials were related to the age distribution [11], similar to our findings here.

Our study shows that the dissection of nodes alongside the distal splenic artery and nodes in the splenic hilum is an intraoperative risk factor. Distal pancreatectomy with splenectomy had the highest odds ratio. However, even when we performed pancreas-preserving total gastrectomy to avoid pancreas-related complications, there was still a considerably higher odds ratio of abscess formation. Pancreas-preserving splenectomy is part of the standard operation in specialized centers in Japan. Splenectomy without dissection along the distal splenic artery also had a high risk of abscess formation.

Japanese retrospective studies have shown that 20%–30% of patients with advanced cancer in the proximal stomach have nodal metastasis in the splenic hilum, and that gastrectomy with resection of these nodes can yield a 5-year survival of 20%–25% [12]. Consequently, in Japan, dissection of nodes in these areas is performed routinely.

Although mortality rates from gastrectomy complicated by pancreas-related abscess are lower in Japan than those reported in Western series [3,4], pancreas-related abscess formation remains a strong factor in the mortality and morbidity rates in both Japanese and Western centers.

Evaluation of the role of splenectomy for proximal gastric cancer is important. Spleen preservation, avoiding thorough nodal dissection in the splenic hilum as well as in the distal splenic artery, as described by groups in the United Kingdom [13,14], should be evaluated in Japan. The Japan Clinical Oncology Group have recently started a randomized controlled trial to evaluate the effect of splenectomy on postoperative morbidity and longterm cancer-free survival [15].

Conclusions

Pancreas-related abscess after gastrectomy is more likely to occur in older, obese patients undergoing node dissection along the distal splenic artery. Because the abscesses are associated with high mortality and re-operation rates, the role and oncologic value of splenectomy has to be considered more carefully. This now forms the basis of a nationwide trial.

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