

Express communication

Comparison of Postoperative Morbidity in Elderly Patients who Underwent Pancreatic Resection

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Running title: Elderly patients undergoing pancreatectomy

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ABSTRACT

Background/Aims: Operative indications for pancreatectomy in elderly patients with pancreatic disease remain controversial. We examined clinicopathological characteristics and early outcomes in each generation of 147 patients who underwent pancreatectomy.

25 **Methodology:** Patients were divided into four groups: Group 1 (n=15, 10%), young patients <50 years old; Group 2 (n=65; 44%), patients at 50-69 years old; Group 3 (n=61, 42%), patients at 70-79 years old; and Group 4 (n=6, 4%), elderly patients >80 years old. Clinicopathological and surgical parameters were examined, including estimation of physiological ability and surgical stress consisting of preoperative risk score (PRS), surgical
30 stress score (SSS), and comprehensive risk score (CRS).

Results: Prevalence of co-morbidity and American Society of Anesthesiologists (ASA) score increased significantly with increasing patient age ($p < 0.05$). Extent of pancreatectomy and lymphadenectomy did not differ between groups, and surgical records were similar. Tumor stage, postoperative course and complications were similar between groups. PRS and CRS
35 increased significantly with increasing patient age ($p < 0.05$), but SSS did not. Univariate analysis identified presence of systemic co-morbidity, ASA score ≥ 2 and PRS ≥ 0.32 as factors associated with postoperative complications, but no independent predictive parameters were identified on multivariate analysis.

Conclusions: Careful management and adequate decisions regarding pancreatectomy upon
40 identification of co-morbidity, ASA score and PRS are important in elderly patients with pancreatic disease before pancreatectomy.

KEY WORDS: elderly patients; pancreatectomy; outcomes; complications; E-PASS

ABBREVIATIONS: American Society of Anesthesiologists (ASA); estimation of
45 physiological ability and surgical stress (E-PASS); preoperative risk score (PRS); surgical

stress score (SSS); comprehensive risk score (CRS); pancreaticoduodenectomy (PD); distal pancreatectomy (DP)

INTRODUCTION

50 Pancreatic resection has become accepted as the most curative treatment modality for patients with pancreatic diseases. The safety of pancreatectomy has improved markedly and mortality rates have decreased with the development of perioperative management and surgical techniques (1-3). With improvements in operative safety, pancreatectomy can now also be applied in elderly patients, although the operative risk is thought to be higher in

55 elderly patients with lower organ functions (4-7). Previous experimental reports have examined the risk of postoperative complications in elderly patients (8), but some details remain unclear. The mean age of patients with peri-pancreatic carcinoma has been around 60-70 years recently (7, 9). As pancreatectomy has recently been applied in elderly patients, the population of elderly patients undergoing such procedures has been increasing (7, 10).

60 Recent reports have shown good postoperative course and similar incidences of morbidity and mortality among elderly patients in comparison with younger patients (4, 7, 11-15). The definition of elderly patients has varied in these reports, as >60, >70, >75 and >80 years old (4, 5, 7, 10-13, 15). The prevalence of elderly patients around 70 years old has been increasing and general conditions may have improved recently in Japan, with the mean age at

65 death currently around 80 years old in our country (<http://www.mhlw.go.jp/toukei/saikin/hw/life/life09/03.html>; *data not published*). Patients receiving treatment have thus gradually been shifting toward elderly patients >80 years old. In Western countries, age has been increasing among patients with pancreatic malignancies who undergo pancreatic resection (7, 11, 15). Riall et al. reported that operative risk was

70 higher in younger patients than in elderly patients (10). Risks in elderly patients with pancreatic disease thus remain controversial. Indications for operative strategies in patients >80 years old do not seem to have been well clarified.

We hypothesized that elderly patients with pancreatic disease could undergo similar pancreatectomies to younger patients if activities of daily living and organ function are preserved. This study aimed to clarify clinicopathological characteristics, surgical results and postoperative early outcomes after pancreatectomy among 147 patients in different age groups with peri-pancreatic disease and to clarify the validity of pancreatectomy for elderly patients at a single Japanese cancer unit.

METHODOLOGY

This retrospective study collected data from 147 patients with pancreatic benign or malignant disease who underwent surgery in the Division of Surgical Oncology at the Department of Translational Medical Sciences, Nagasaki University Graduate School of Biomedical Sciences (NUGSBS), Japan, and associated cancer institutes between January 85 1994 and August 2009.

All patients were medically fit for major laparotomy and showed no signs of preoperative dissemination or distant metastases. Each patient underwent routine preoperative imaging such as whole-abdomen computed tomography (CT), magnetic resonance imaging (MRI) and 90 endoscopic retrograde cholangio-pancreatography. All study protocols were approved by the ethics review board of our department at NUGSBS. Mortality and morbidity data were collected from the NUGSBS database and provided by collaborating hospitals. No financial support was received for this study, and the authors have no conflicts of interests to declare.

In the present series, pancreaticoduodenectomy (PD) was the basic surgical option for 95 peri-pancreatic diseases and distal pancreatectomy (DP) was selected for pancreatic tumors in the body or tail of pancreas. Lymphadenectomy for malignant diseases was basically performed in Group 2 lymph nodes and lymph nodes in the para-aortic region (station numbers 16a2 and 16b1) according to the *Classification of Biliary Tract Carcinoma* and *Classification of Pancreatic Carcinoma* in Japan (16, 17). The extrapancreatic nerve plexus 100 was also resected in the half around the supra-mesenteric artery for invasive ductal carcinomas. In cases undergoing PD, Child's intestinal reconstruction with end-to-side anastomosis for pancreatojejunostomy was routinely selected. In cases undergoing DP, the pancreatic stump was closed by suturing in a fish-mouth shape.

In cases of tumor involvement to the portal vein or supra-mesenteric vein (SMV) and 105 splenic vein, radical operation was considered. When combined resection of the portal vein or

SMV was performed, end-to-end anastomosis of vessels was applied. Fibrin glue was used to prevent pancreatic fistula.

With respect to patient age in the present study, subjects were divided into four subgroups, as follows: Group 1, young patients <50 years old; Group 2, patients at 50-69 years old; 110 Group 3, patients at 70-79 years old; and Group 4, elderly patients >80 years old. We recorded the following clinical parameters: patient demographics including co-morbidities; performance status (PS); American Society of Anesthesiologists (ASA) score (18); preoperative risk score (PRS); surgical stress score (SSS); comprehensive risk score (CRS) (19, 20); background of pancreatic inflammation; preoperative laboratory data; surgical 115 records; macroscopic tumor findings; histological findings; presence of hard pancreas; postoperative complications comprising pancreatectomy-associated complications and systemic complications; mortality; and duration of hospitalization. Blood samples were obtained before the morning meal for measurement of serum carbohydrate antigen (CA)19-9 (Elecsys[®] CA19-9 II; Roche Diagnostics, Indianapolis, IN) and serum levels of CA19-9 >37 120 U/ml were considered elevated. Surgically resected specimens were fixed in 10% formalin and lymph nodes were sectioned serially at 5-mm intervals, stained with hematoxylin and eosin and examined microscopically. Tumor stage was based on the *Classification of Biliary Tract Carcinoma* by the Japanese Society of Biliary Surgery and the *Classification of Pancreatic Carcinoma* by the Japan Pancreas Society [16, 17].

125 PRS, SSS and CRS were determined using Haga's equations for estimation of physiological ability and surgical stress (E-PASS) (19, 20) as:

$$\text{PRS} = -0.0686 + 0.00345 X_1 + 0.323 X_2 + 0.205 X_3 + 0.153 X_4 + 0.148 X_5 + 0.0666 X_6$$

where X_1 is age, X_2 is presence (1) or absence (0) of severe heart disease, X_3 is presence (1) or absence (0) of severe pulmonary disease, X_4 is presence (1) or absence (0) of diabetes

130 *mellitus*, X_5 is performance status index (0-4), and X_6 is ASA physiological status
classification (1-5).

$$\text{SSS} = -0.342 + 0.0139 X_1 + 0.0392 X_2 + 0.352 X_3$$

where X_1 is blood loss/body weight (g/kg), X_2 is operation time (h), and X_3 is extent of skin
incision (0, minor incision for laparoscopic or thoracoscopic surgery; 1, laparotomy or
135 thoracotomy alone; 2, both laparotomy and thoracotomy).

$$\text{CRS} = -0.328 + 0.936 (\text{PRS}) + 0.976 (\text{SSS})$$

Continuous data are expressed as mean \pm standard deviation. Data for different groups
were compared using one-way analysis of variance, followed by Student's *t*-test or Dunnet's
multiple comparison test. In univariate analysis, categorical data were analyzed using the
140 chi-square test or Fisher's exact test. The median value was identified as the cutoff age value
for E-PASS score. Multivariate logistic regression analysis was performed to identify factors
predictive of systemic complications. Two-tailed values of $p < 0.05$ were considered
significant. Statistical analyses were performed using SAS software (Statistical Analysis
System, Cary, NC, USA).

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RESULTS

The study group included 96 men (65%) and 51 women. Mean and median ages were 65±13 years (range, 18-87 years) and 68 years. There were 15 patients (10%) in Group 1, 65 (44%) in Group 2, 61 (42%) in Group 3, and 6 (4%) in Group 4, respectively. Operative procedure was PD in 113 patients (77%, including pylorus-preserving PD in 54 patients and PD with hepatic resection in 7 patients) and DP in 34 patients (23%). Tumors were completely resected without residual tumor in all patients.

Four patients in Group 1, 21 patients in Group 2, 14 patients in Group 3 and 1 patient in Group 4 were treated between 1994 and 1999. Five patients in Group 1, 22 patients in Group 2, 19 patients in Group 3 and no patients in Group 4 were treated between 2000 and 2004. Six patients in Group 1, 22 patients in Group 2, 28 patients in Group 3 and 5 patients in Group 4 were treated between 2005 and 2009. Prevalence of Group 3/4 was 38%, 41% and 54% in each period, respectively. However, no significant differences in prevalence of Group 3/4 patients were seen according to different study periods ($p=0.20$).

Table 1 shows clinicopathological and surgical parameters in each group. Prevalence of women tended to be higher in Group 4 than in other groups ($p=0.052$). Prevalence of systemic comorbidities such as hypertension, angina, diabetes or chronic renal failure was significantly lower in Group 1 than in other groups ($p<0.05$). ASA scores of 2 and 3 were significantly more common with older patients ($p<0.05$). Preoperative laboratory data and surgical records did not differ significantly between groups. Extended lymphadenectomy was aggressively performed even in Group 4. Prevalence of re-operation was not significantly different between groups. Table 2 shows tumor stage, patient outcomes and E-PASS scores. Tumor stage and postoperative outcomes did not differ significantly between groups. PRS and CRS by E-PASS score in Group 1 were significantly lower than those in other groups, respectively ($p<0.05$).

Systemic co-morbidity and higher PRS and CRS from the E-PASS score were significantly associated with postoperative complications after pancreatectomy in univariate analysis (Table 3) ($p < 0.05$). Furthermore, ASA score, pancreatic procedure (PD), and soft pancreas tended to be associated with postoperative complications after pancreatectomy. By applying these 6 parameters, multivariate logistic regression analysis was used to examine predictors of postoperative complications. However, no parameters significantly associated with postoperative complications were identified (Table 4).

DISCUSSION

Elderly patients with pancreatic disease who undergo pancreatic resection have been increasing recently despite the poor prognosis for peri-pancreatic carcinomas (4, 5, 7, 10-13, 15). Although elderly patients are considered to be high-risk subjects for extended
185 pancreatotomy because of the high rate of systemic comorbidities such as cardiopulmonary diseases or diabetes, a few reports have shown that younger patients are at greater risk than elderly patients (7, 10, 13). Elderly patients with good performance status and organ functions have been increasing (21) and the prevalence of elderly cancer patients with good general condition may continue to increase in the future. In reports concerning elderly
190 patients undergoing pancreatotomy, the definition of elderly patients has varied, with >50 years old (6), >60 years old (4,10, 22), >70 years old (5, 23), >75 years old (12-14, 24, 25) and >80 years old (11, 15), and most recent studies appear to have defined elderly as >70 years old. These reports have shown improvements in postoperative complications and patient outcomes, and aggressive surgical treatment for pancreatic malignancy has thus been
195 increasingly accepted in elderly patients (4, 7, 11-14, 25, 26). On the other hand, elderly patients still have a high rate of concomitant systemic disease and the functional reserve of multiple organs may be lower than in younger patients (7, 27, 28). With increasing patient age, peri-operative management is problematic in the field of pancreatotomy. The present study therefore focused on characteristics of elderly patients with pancreatic diseases who
200 underwent extended pancreatotomy at 70-79 years old and >80 years old in comparison with younger patients, to clarify problems in the peri-operative management and operative indications for pancreatotomy. The present study found that the prevalence of elderly patients has not increased significantly and that elderly patients over 70 or 80 years old might meet the indications for extended pancreatotomy. The elderly have already comprised over
205 50% of patients in recent years and this trend will probably continue.

Many reports have examined relationships between pancreatic surgery and elderly patients (4, 5, 7, 10-13, 15, 22-28). Some of those reports have shown old age as a significant risk factor for worsened postoperative outcomes of pancreatectomy (6, 7, 10, 11, 22, 23, 25, 26), while others have shown no difference between younger and elderly patients (4, 12-15).
210 This issue thus remains controversial. Some reports have suggested that postoperative complications and mortality are lower at high-volume centers in comparison with low-volume institutes and high-risk patients such as the elderly should undergo pancreatic surgery by expert surgeons at high-volume institutes (7, 15, 26, 28). With respect to chemoradiotherapy in unresectable peri-pancreatic malignancies, elderly patients show an
215 increased risk of side effects and may not achieve completion of the scheduled treatment (29).

With respect to other risk factors for outcomes in patients undergoing pancreatectomy, diabetes and obesity have been suggested as associated factors (27, 30, 31). As reported previously, preoperative systemic complications other than pancreatic disease are more
220 frequent and ASA scores are higher in elderly patients (7, 13, 23, 28). These factors are important for deciding operative indications. However, when PS was maintained, frequency of metabolic disease and body weight did not differ between age groups in our series. Patients in Group 1 tended to show higher body weight and Li et al. pointed out that young patients with a high body mass index show high morbidity rates (31). Interestingly, female patients
225 tended to be increased with increasing age according to our results, which might be due to population trends in Japan. As described later, PRS affected by co-existing complications correlated significantly with increasing patient age. Elderly patients may be theoretically risky candidates, because high PRS has previously been identified as a risk factor in pancreatectomy (32, 33). Preoperative pancreatic functions were also maintained in elderly
230 patients, and patients with well-preserved status might have been selected in our series.

In the present series, operative procedures and surgical records and prevalence of re-operation did not differ between groups. Furthermore, extended lymphadenectomy as D2 or more was also performed more often in Groups 3 and 4 in comparison with younger patients. Actually, we did not intend to change operative procedures or extent of lymphadenectomy even in elderly patients with malignancies. Pancreaticoduodenectomy was performed aggressively in patients >80 years old in our series, although Hill et al. reported that PD showed a double risk in comparison with distal pancreatectomy (22). Yoshioka et al. reported that extension of lymphadenectomy leads to increased rates of morbidity and mortality (34). We believe that this is due to the complexity of the operative procedure, rather than differences in patient ages. Soft pancreas is a significant risk factor for pancreatic fistula or intra-abdominal infection (35), but prevalence did not differ between groups. Most previous reports have accepted elderly patients for PD or DP (4, 5, 7, 10-13, 15, 22-28).

With respect to tumor stage in elderly patients, no definite tendencies have been found in some reports (7, 14, 15). In the present study, TNM stage did not differ significantly between groups, but the most advanced stage IVb carcinoma was not included in Group 4. This severely advanced stage of cancer might have been avoided in our series, although we might have evaluated operative indications concerning PS and tumor-related factors without discriminating between ages in this series.

With respect to postoperative outcomes after pancreatectomy in elderly patients, frequencies of postoperative complications have ranged between 3.5% and 53%, while mortality rates of 2-9% have been described (1, 11, 12, 25,36, 37). Makary et al. reported that mortality rates in elderly patients were increased in comparison with younger patients (11). Conversely, McPhee et al. reported a decrease in mortality rates among elderly patients (37). Ballarin et al. recently showed no difference in duration of hospitalization between elderly and younger patients (14). As described above, elderly patients already had the preoperative

risk factors and this result might have been associated with postoperative complications. In the present study, postoperative nutritional status, morbidity and mortality rates and duration of hospitalization did not differ between elderly and younger patients. Based on our experience, in cases where elderly patients had severe postoperative complications, quality of life and ability to perform activities of daily living were markedly decreased (data not shown). This tendency seemed to be marked in elderly patients. Pratt also pointed out that recovery was delayed in cases of elderly patients with complications (23). Among elderly patients, such delayed recovery represents a serious problem because of the lower functional reserve of multiple organs and muscular activity.

Postoperative risk for morbidity and mortality has been evaluated using risk scores such as APACHE II and POSSUM scores (38, 39). However, adequate evaluation has not been fully achieved using these scoring systems. Haga *et al.* recently proposed the new scoring system of the E-PASS score to predict postoperative morbidity and mortality (19, 20). E-PASS more accurately reflected complications in comparison with POSSUM following liver surgery (40) and has recently been usefully applied to evaluate patients after abdominal or thoracic surgery (32, 33, 41). Hattori *et al.* applied this score to evaluate elderly patients after pancreatic surgery (42). E-PASS uses 3 parameters: PRS; SSS; and CRS. PRS indicates preoperative co-morbidities and SSS represents the severity of the operation. CRS is a comprehensive evaluation using PRS and SSS (19, 20). In the present study, PRS increased significantly with age, particularly in Groups 3 and 4. However, mean PRS in all groups was lower than the cut-off risk values of 0.55 or 0.7 identified in previous reports (19, 20, 32, 33, 41). Patient selection for pancreatectomy might well be achieved at any age using only the PRS. SSS in Groups 1-3 was higher than the risk value of 0.4 reported by Hashimoto *et al.* (32, 33) because of the longer operating time and large amount of blood loss in cases of pancreatectomy. SSS did not differ significantly between groups in the present study, so

treatment selection might not be performed with any consideration of age in our study described as above. CRS was well applied to evaluating postoperative risk. Previous reports have suggested a CRS score of 0.4 or 0.574 suggests risk of postoperative morbidity (19, 20, 32, 33, 41). Our results showed CRS between 0.36-0.78 in the 4 groups, beyond these risk values in Groups 2 and 3, but not in Group 4. These values may be useful to evaluate operative risk, decide operative indications and select patients with increased risk of morbidity. In the next step, we attempted to examine parameters associated with postoperative complications, and preoperative parameters such as presence of systemic complications, higher ASA score (≥ 2), and PRS (≥ 0.32) were associated with postoperative complications according to our univariate analysis. However, no parameters independently associated with postoperative complications could be identified. To clarify the significance of these parameters, a larger number of patients from multiple institutes should be examined. At this stage, we must carefully select or manage indications for pancreatectomy for elderly patients with high PRS. Hagara *et al.* pointed out a high mortality rate in patients with CRS >1.0 , so we must also carefully check the balance of patient preoperative condition according to age and PRS and surgical stress as evaluated by SSS in the future to avoid severe postoperative complication or mortality.

In conclusion, we analyzed patient demographics, clinicopathological factors, surgical records and E-PASS scores in elderly patients with pancreatic disease who had undergone pancreatic resection, and compared data among four subgroups of patient age. Frequencies of comorbidity and lower general status were significantly higher in elderly patients. Systemic postoperative complication and ASA score were higher in elderly patient, but no differences were seen for hospital stay. The PRS for E-PASS increased with increasing patient age. PRS ≥ 0.32 tended to be associated with postoperative complications. Careful follow-up and adequate decisions on treatment modality upon identification of systemic complications,

ASA score and PRS are important in patients undergoing pancreatectomy. Further studies are needed to improve preoperative risk evaluation in elderly patients.

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Table 1. Relationship between Patient Age and Demographics, Clinicopathological Findings and Surgical Records

	Group 1 (<50 y; n=15)	Group 2 (50-69 y; n=65)	Group 3 (70-79 y; n=61)	Group 4 (≥ 80 y; n=6)	P
Sex (male/female)	10/5	47/18	38/23	1/5	0.052
Body weight (kg)	59 \pm 8	57 \pm 9	55 \pm 9	48 \pm 5	
Systemic morbidity (no/yes)	12/3	25/40	19/42	2/4	0.006
Diabetes mellitus (no/yes)	14/1	42/23	46/15	4/2	0.13
Chronic pancreatitis (no/yes)	11/4	46/19	47/14	6/0	0.43
Performance status (0/1)	15/0	64/1	60/1	6/0	0.95
ASA (1/2/3)	13/2/0	42/18/5	20/31/10	0/6/0	<0.001
Diseases					
Benign/LGM/BC/PC/Other *	2/2/6/5/0	4/2/27/28/4	2/8/27/23/1	0/1/0/5/0	0.22
Albumin level (g/dl)	3.9 \pm 0.7	4.0 \pm 0.4	3.8 \pm 0.4	3.9 \pm 0.4	
Amylase level (IU/l)	214 \pm 352	180 \pm 222	118 \pm 125	55 \pm 36	
PFD test (%)	67 \pm 23	63 \pm 13	59 \pm 19	58 \pm 13	
Pancreatectomy					
PD/DP	6/9	55/10	49/12	3/3	0.13
Blood loss (ml)	1132 \pm 737	1440 \pm 811	1352 \pm 943	466 \pm 297	
Blood loss/weight (ml/kg)	19 \pm 12	26 \pm 15	25 \pm 18	10 \pm 7	
Operation time (min)	486 \pm 156	570 \pm 177	566 \pm 222	451 \pm 231	
Incision					
L/M/MT	1/14/0	1/62/2	1/55/5	1/5/0	0.19
Hard pancreas (no/yes)	10/5	43/22	43/18	4/2	0.18
Lymphadenectomy					
No/D1/D2 or more**	4/1/10	3/6/56	3/6/52	0/4/2	<0.001
Re-operation (no/yes)	13/2	64/1	56/5	6/0	0.12

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ASA, American Society of Anesthesiologists; LGM, low-grade malignancy; BC, biliary carcinoma; PC, pancreatic carcinoma; PFD, pancreatic functioning diognostant; PD, pancreaticoduodenectomy; DP, distal pancreatectomy; L, laparoscopy; M, median laparotomy; MT, median plus transverse laparotomy.

* Other malignancy: duodenal carcinoma, metastatic carcinoma, or gastrointestinal stromal
440 tumor.

** Extent of node dissection according to the *Classification of Biliary Tract Carcinoma* (16)
and *Classification of Pancreatic Carcinoma* (17) in Japan.

Table 2. Relationship between Patient Ages and Histological Findings, Tumor Relapse,

445 Outcomes and E-pass Scores

	Group 1 (n=15)	Group 2 (n=65)	Group 3 (n=61)	Group 4 (n=6)	P
TNM stage (I/II/III/IVa/IVb)*	1/1/0/5/2	6/8/9/20/6	1/11/16/13/6	0/2/2/2/0	0.25
Change in body weight (kg)	-1.9± 3.7	-3.0± 3.2	-2.7± 2.5	-4.6± 2.4	
Start of oral intake (days)	20±18	15±8	22±17	7±3	
Postoperative morbidity (no/yes)	8/7	27/38	18/43	3/3	0.25
Pancreatic fistula (no/yes)	13/2	59/6	49/12	6/0	0.60
Systemic complications (no/yes)	15/0	57/8	50/11	6/0	0.21
Hospital death (no/yes)	15/0	65/0	59/2	6/0	0.41
Hospital stay (days)	36±20	41±20	42±23	30±14	
PRS	0.15± 0.08* **	0.32± 0.15 [†]	0.40± 0.17	0.40± 0.08	
SSS	0.57± 0.22	0.75± 0.30	0.75± 0.41	0.38± 0.13	
CRS	0.36± 0.25 [¶] §	0.70± 0.34	0.78± 0.43	0.42± 0.18	

* Based on the *Classification of Biliary Tract Carcinoma* (16) and *Classification of Pancreatic Carcinoma* (17) in Japan.

* p<0.01 vs. Group 2 and 3; ** p<0.05 vs. Group 4; [†] p<0.05 vs. Group 3; [¶] p<0.01 vs. Group 3; [§] p<0.05 vs. Group 2.

450 PRS, preoperative risk score; SSS, surgical stress score; CRS, comprehensive risk score (23,24)

Table 3 Multivariate Logistic Regression Analysis of Postoperative Complications

	Complication (-) (n=56)	Complication (+) (n=91)	P
Gender (male/female)	33/23	62/29	0.41
Age (groups 1/2/3/4)	8/27/18/3	7/38/43/3	0.25
Systemic morbidity (no/yes)	30/26	28/63	0.011
Diabetes mellitus (no/yes)	45/11	61/30	0.12
Chronic pancreatitis (no/yes)	43/13	67/24	0.82
Performance status (0/1)	56/0	89/2	0.53
ASA (1/2/3)	34/20/2	41/37/13	0.055
Pancreatectomy (PD/DP)	21/35	43/48	0.052
Blood loss (<1000 ml/≥1000 ml)	31/25	37/54	0.12
Operation time (<300 min/≥300 min)	5/51	3/88	0.26
Incision (L/M/MT)	120/56	9/3	0.84
Hard pancreas (no/yes)	33/23	64/27	0.09
Lymphadenectomy (No/D1/D2 or more)	6/8/42	4/9/78	0.26
PRS (<0.32/≥0.32)	35/21	35/56	0.008
SSS (<0.64/≥0.64)	33/23	40/51	0.11
CRS (<0.61/≥0.61)	37/19	35/56	0.002

See Tables 1 and 2

Table 4. Multivariate Logistic Regression Analysis of Systemic Complication

	HR	95%CI	P
Systemic morbidity			
no vs. yes	1.55	0.63-4.0	0.34
ASA			
1 vs. 2	1.14	0.45-2.93	0.38
1 vs. 3	2.22	0.36-14.31	
Pancreatectomy			
DP vs. PD	2.0	0.77-5.26	0.15
Hardness of pancreas			
hard vs. soft	1.87	0.70-5.30	0.21
PRS			
<0.32 vs. \geq 0.32	1.92	0.69-5.26	0.22
CRS			
<0.61 vs. \geq 0.61	1.98	0.79-4.76	0.14

HR, hazard ratio; CI, confidence interval.

See Tables 1 and 2