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ORIGINAL ARTICLE

Risk factors associated with delayed haemorrhage after pancreatic resection

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Abstract

Background: Delayed haemorrhage (DH) is a life-threatening complication of pancreatic resection (PR) and the mortality rate for DH is very high. However, the risk factors and prognostic factors associated with DH are rarely evaluated.

Methods: A pancreatic resection was performed on 457 patients. Delayed haemorrhage was defined as bleeding from the surgical site ≥5 days after PR. Risk factors for DH were assessed according to demographics and pathological and operative parameters. Prognostic factors after DH were evaluated for the shock index (heart rate/systolic blood pressure) and systemic inflammatory response syndrome (SIRS) scores.

Results: Of the 457 patients, 11 (2.4%) experienced DH after PR. Logistic regression analysis showed that age >60 years and a diagnosis of malignant disease were risk factors for DH. The shock index and SIRS scores at the onset of DH were significantly higher in patients who died as compared with those patients that survived ($P < 0.05$).

Discussion: PR-associated DH carries an increased risk for patients aged >60 years with malignant disease. Prognostic factors were a shock index score ≥0.7 and SIRS at the onset of DH.

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Introduction

The mortality rate after pancreatic surgery has been decreasing over the past decade, especially in high-volume centres, and is currently below 5%.[1–3] This decreased rate has led to an increase in the number of patients undergoing pancreatic resection (PR).[4] In spite of progression of surgical techniques and peri-operative management for pancreatic surgery, morbidity is still high, with a rate of 18–54%.[1,5–9] The most frequent complications after PR are delayed gastric empting, pancreatic leakage and local infection.[10]

Haemorrhage after PR occurs in 2–15% of patients in the early or late postoperative phase,[8,11] but is one of the most serious complications with a mortality rate of 15–58%.[8,12] In particular, delayed haemorrhage (DH), which is a life-threatening complication after PR, is rarely reported.[1,9,11,13–18]

The development of a systemic inflammatory response syndrome (SIRS) response has been shown to be an early warning sign of underlying problems in surgical patients.[19,20] However, the relationship between DH after PR and a SIRS response or a concomitant poor score on the shock index[21] is unclear. Therefore, the aim of this study was to evaluate the risk factors of PR-associated DH and the prognostic factors after DH.

Patients and methods

The clinical records of all patients who underwent PR were retrospectively analysed with regard to DH after PR. All patients provided written informed consent to participate before undergoing surgery. Delayed haemorrhage was defined as bleeding from the surgical site ≥5 days after PR, and this was further restricted to patients that required a blood transfusion >2 U of packed red blood cells, intensive treatment such as laparotomy or transarterial embolization (TAE) and surgical intensive care unit supervision. In all patients, initial management involved transarterial embolization; if haemostasis was not achieved, patients proceeded to laparotomy. Risk factors for DH after PR were assessed

according to demographics, pathological diagnosis and operative procedure. Prognostic factors after DH were evaluated for the following variables: shock index score, SIRS score, C-reactive protein and white blood cells at the onset of hemorrhage. The shock index was defined as heart rate divided by systolic blood pressure.[21] For SIRS scoring, the method originally described by Bone *et al.* was used.[22] Briefly, the four criteria of SIRS are as follows: (i) white blood cell count >12 000 cells/mm^3, or <4000 cells/mm^3, or >10% cells with immature form; (ii) temperature >38°C or <36°C; (iii) heart rate >90 beats per minute; and (iv) respiratory rate >20 breaths per minute or $PaCO_2$ < 32 mm Hg. According to these criteria, patients were given a SIRS score of 0–4 at the onset of haemorrhage. SIRS is defined by the presence of ≥2 of the criteria. In this study, a post-operative pancreatic fistula (POPF) was defined and classified using the International Study Group on Pancreatic Fistula (ISGPF) criteria.[23]

Risk factors for DH and prognostic factors after DH were investigated using logistic regression analysis. A statistical difference was considered significant at $P < 0.05$.

Results

Patients with DH after PR

A pancreatic resection was performed on 457 patients [206 (45%) female, with a median (range) age of 66 (14–87) years] at Kumamoto University between February 1989 and February 2010. Of these 457 patients, 11 [2.4%; 4 female; median (range) age 73 (61–79) years] experienced DH. Delayed haemorrhage was experienced at a median (range) 18 (8–39) days after PR. A prompt laparotomy and haemostasis was performed in 4 patients; 1 survived, but 3 died within 74 days, with a median survival time of 29 days after reoperation. Transarterial embolization was performed in 7 patients, including a sequential laparotomy in 2 patients; 3 survived, but 2 died within 205 days after transarterial embolization. Haemorrhage foci were peripancreatic arteries in 10 patients (superior mesenteric artery in 1, common hepatic artery in 1, proper hepatic artery in 1, splenic artery in 4, left gastric artery in 2, and middle hepatic artery in 1) and the pancreaticogastrostomy site in 1 patient. Pancreatic cancer was diagnosed in 7 patients, bile duct cancer in 2, an endocrine tumour of the pancreas in 1 and gallbladder cancer in 1. All patients who experienced DH had a pancreatic fistula ISGPF grade B before DH.

Risk factors associated with DH after PR

Risk factors associated with DH after PR were assessed. All 11 patients with DH were >60 years and age was found to be a significant risk factor ($P = 0.018$). Moreover, all patients with DH had been diagnosed with malignant disease, which also proved to be a significant risk factor ($P = 0.001$). Other parameters, including gender and operative procedure, were not risk factors statistically.

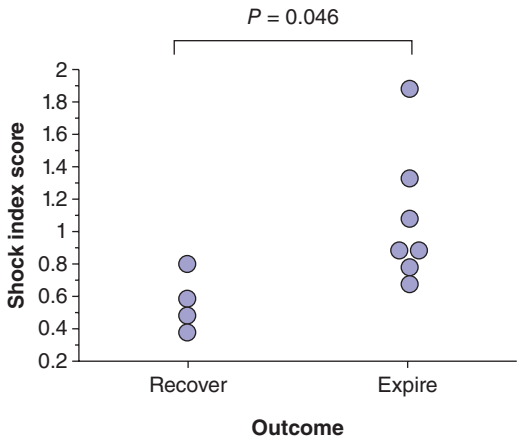

Figure 1 Correlation of the shock index score between recovered and expired patients. The shock index score was significantly lower in recovered patients than in expired patients ($P = 0.001$)

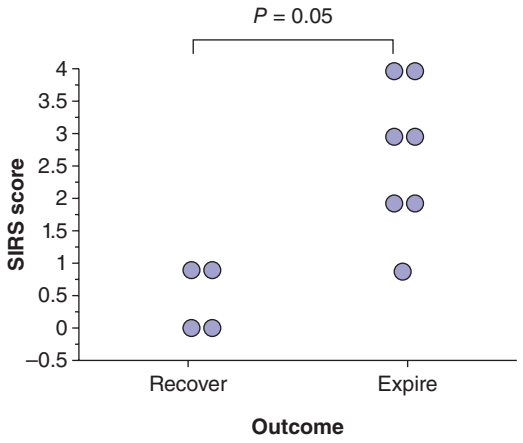

Figure 2 Correlation of systemic inflammatory response syndrome (SIRS) score between recovered and expired patients. The SIRS score was significantly lower in recovered patients than in expired patients ($P = 0.001$). All expired patients experienced SIRS at the onset of delayed haemorrhage

Prognostic factors after DH

Prognostic factors were evaluated after DH. The mean shock index at the onset of DH was 0.6 (0.4–0.8) in those patients who survived, compared with 1.1 (0.7–1.9) in those patients who died (Fig. 1) ($P = 0.046$). The SIRS score was 0 and 1 in those patients that survived and from 1 to 4 in those patients that died (Fig. 2) ($P = 0.05$), indicating that all patients who died after DH were diagnosed with SIRS at the onset. Logistic regression analysis revealed that the shock index and SIRS scores were significant prognostic factors after DH ($P = 0.001$).

The C-reactive protein at onset of DH was a median (range) 2.98 mg/dl (2.27–14.32) in patients who survived compared with 3.35 mg/dl (1.60–11.36) in those patients that died ($P = 0.988$). The median (range) white blood cell count at onset of DH was a