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• CLINICAL RESEARCH •

Organ failure associated with severe acute pancreatitis

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Abstract

AIM: To investigate the relationship between severe acute pancreatitis (SAP) and organ failure.

METHODS: Clinical data of 74 cases of SAP from Jan. 1993 to Dec. 2002 were retrospectively reviewed, and the relationship between organ failure and age, gender, etiology, extent of necrosis, infection of necrosis and mortality was analyzed.

RESULTS: A total of 47 patients (63.5 %) showed organ failure, 20 patients (27.0 %) multiple organ failure, whereas 27 patients (36.5 %) with dysfunction of a single organ system. Pulmonary failure was the most common organ dysfunction (23.0 %) among single organ failures. There were no significant differences in age, gender and gallstone pancreatitis among patients with or without organ failure ($P>0.05$). The incidence of organ failure in infected necrosis was not higher compared with sterile necrosis, and patients with increased amount of necrosis did not have an increased prevalence of organ failure ($P>0.05$). Patients with organ failure had a higher mortality rate compared with those without organ failure ($P<0.05$). The death of SAP was associated with multiple organ failure ($P<0.005$), pulmonary failure ($P<0.005$), cardiovascular dysfunction ($P<0.05$) and gastrointestinal dysfunction ($P<0.05$).

CONCLUSION: Organ failure is common in patients with SAP, and patients with multiple organ failure and pulmonary failure have a higher mortality rate. Prevention and active treatment of organ failure can improve the outcome of patients with SAP.

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INTRODUCTION

Severe acute pancreatitis (SAP), as a common acute abdomen, is characterized by complicated causes, lots of morbidities, difficulties in the treatment, and high mortality[1-8]. The natural course of SAP progresses in two phases. The first 14 days are characterized by systemic inflammatory response syndrome resulted from the release of inflammatory mediators. In patients with SAP, organ failure is common and often occurs in the absence of infection. The second phase, beginning approximately 2 weeks after the onset of the disease, is dominated by sepsis-related complications resulted from infection of pancreatic necrosis. This is associated with multiple systemic complications, such as pulmonary, renal, and cardiovascular failure[9-18]. Despite considerable improvements in understanding of the pathophysiologic mechanisms and management of these patients, mortality of SAP remains between 15-50 %[19-22]. Organ failure is a severe complication of SAP and death occurs usually only in patients with SAP and is commonly associated with failure of at least one organ system[23-25]. From Jan. 1993 to Dec. 2002, a total of 74 patients with a diagnosis of SAP were admitted to Department of Hepatobiliary Surgery, the First Hospital of Xi' an Jiaotong University, 12 patients died in hospital. The aim of this study was to analyze the relationship between extent of necrosis, pancreatic infection, hospital death due to organ failure.

MATERIALS AND METHODS

Patients

From Jan. 1993 to Dec. 2002, a total of 74 patients with a diagnosis of SAP were admitted to Department of Hepatobiliary Surgery, the First Hospital of Xi' an Jiaotong University. Pancreatic necrosis was defined by findings on CT scan or in operation. There were 40 men and 34 women with a ratio of 1.18:1, the average age of the patients was 49.3 years (range 14-94). The presence of infected necrosis was determined by bacterial culture of CT or ultrasonography-guided percutaneous aspiration and pancreatic tissues debrided at surgery. Organ failure was defined according to the Criteria of Clinical Diagnosis and Classification System for Acute Pancreatitis (the second project, 1996, Pancreatic Surgery Association of CMA)[26]. Causes of SAP were identified as gallstone and non-gallstone. Initial management of these patients included bowel rest, gastric secretions, intravenous fluid resuscitation, suppression of pancreatic external secretion, and use of prophylactic antibiotics. The indication for surgical treatment was difined in the following instances, such as infection of necrosis, pancreatic abscesses, cholangitis, obstructive jaundice and pseudocyst formation for a long time.

Methods

The patients were divided into two groups according to patients with or without organ failure within 2 weeks after admission. The differences of age, gender, gallstone pancreatitis, APACHE II scores, and mortality were analyzed. According to the results of CT scan and findings in operation, the extent of pancreatic necrosis was estimated to be (1) <33 %, (2) 33-50 %, (3) >50 %. The relationship of organ failure to the extent of pancreatic necrosis and infection of necrosis was analyzed. Finally, the relationship between multiple organ failure and specific single organ failure with infected necrosis and mortality was evaluated.

Statistics

Continuous data were evaluated by *t* test, and categorized data were analyzed by Chi-square test. Significance was defined by $P<0.05$.

RESULTS

There were no significant differences in age, sex, gallstone

pancreatitis. Mortality and APACHE II scores were significantly higher in patients with organ failure than in those without organ failure (P<0.05 and P<0.001, respectively) (Table 1).

Table 1 Characteristics of 74 patients with or without organ failure

	Organ failure (n=47)	No organ failure (n=27)	Sig.
Age (Y)	48±15	49±15	NS
Gender (M/F)	26/21	14/13	NS
Etiology			
Gallstones	21	11	NS
Non-gallstones	26	16	
APACHE II scores	29±7	23±3	<0.001
Mortality (%)	12/47(25.5)	0	<0.05

Among the 74 patients, 20 patients (27.0 %) showed multiple organ failure (maximum 5 organ systems) and 9 of them died, 27 patients showed single organ failure. In patients suffering from single organ failure, 17 patients (23.0 %) had pulmonary failure and 3 patients (17.6 %) died, 7 patients showed hepatic failure and 3 patients showed gastrointestinal failure, but none of these patients died. No patient in this group was accompanied by cardiovascular failure, renal failure, or neurologic failure (Table 2).

Table 2 Number of patients with organ failure in 74 patients

Organ failure	Morbidity(%)	Mortality(%)
Multiple organ failure	20(27.0 %)	9(45 %)
Specific single organ failure		
Pulmonary failure	17(23.0 %)	3(17.6 %)
Renal failure	0	0
Cardiovascular failure	0	0
Hepatic failure	7(9.4 %)	0
Neurologic failure	0	0
Gastrointestinal failure	3(4.1 %)	0

As for the frequency of different specific single organ failure, pulmonary failure occurred in 45.9 % (34/74), renal failure in 16.2 % (12/74), cardiovascular failure in 17.6 % (13/74), hepatic failure in 18.9 % (14/74), neurologic failure in 5.4 % (4/74) and gastrointestinal failure in 10.8 % (8/74) (Table 3).

Table 3 Frequency of organ failure in 74 patients

Organ failure	No. organ failure	Frequency (%)
Multiple organ failure	20	27.0
Pulmonary failure	34	45.9
Renal failure	12	16.2
Cardiovascular failure	13	17.6
Hepatic failure	14	18.9
Neurologic failure	4	5.4
Gastrointestinal failure	8	10.8

No relationship was found between organ failure to the extent of necrosis and infected necrosis (Tables 4, 5). No difference was found between patients with infected necrosis and those with sterile necrosis in the development of multiple organ failure and specific organ failure (Table 6). Nevertheless patients died in hospital had a significantly higher incidence rate of multiple organ failure, pulmonary failure, cardiovascular failure and gastrointestinal failure compared with survivors (Table 7).

Table 4 Relationship between infected versus sterile necrosis and organ failure in 74 patients

	Organ failure (%)	No. organ failure (%)
Sterile necrosis	31(66.0)	16(34.0)
Infected necrosis	16(59.3)	11(40.7)

Note: χ^2=0.3320, P>0.05.

Table 5 Relationship between amount of necrosis and organ failure in 74 patients

Amount of necrosis (%)	Organ failure (n=47)	No. organ failure (n=27)
<33 %	21(55.3 %)	17(44.7 %)
33-50 %	11(64.7 %)	6(35.3 %)
>50 %	15(78.9 %)	4(21.1 %)

Note: χ^2=3.0784, P>0.05.

Table 6 Relationship between infected versus sterile necrosis and single organ failure in 74 patients

Organ failure (%)	Sterile necrosis (n=47)	Infected necrosis (n=27)	χ^2	Sig.
Multiple organ failure	13(27.7 %)	7(25.9 %)	0.0261	NS
Pulmonary failure	24(51.1 %)	10(37.0 %)	1.3585	NS
Renal failure	6(12.8 %)	6(22.2 %)	1.1287	NS
Cardiovascular failure	10(21.3 %)	3(11.1 %)	1.2237	NS
Hepatic failure	7(14.9 %)	7(25.9 %)	1.3607	NS
Neurologic failure	4(8.5 %)	0		NS[a]
Gastrointestinal failure	4(8.5 %)	4(14.8 %)	0.7068	NS

a: Fisher's exact probabilities test.

Table 7 Relationship between hospital death and organ failure in 74 patients

Organ failure	Survivor (n=62)	Nonsurvivor (n=12)	χ^2	P value
Multiple organ failure	11(17.7 %)	9(75 %)	16.7130	<0.005
Pulmonary failure	22(35.5 %)	12(100 %)	16.8501	<0.005
Renal failure	8(12.9 %)	4(33.3 %)	1.7680	NS
Cardiovascular failure	8(12.9 %)	5(41.7 %)	3.9295	<0.05
Hepatic failure	11(17.7 %)	3(25 %)	0.0342	NS
Neurologic failure	0	4(33.3 %)		NS[a]
Gastrointestinal failure	4(6.5 %)	4(33.3 %)	5.0050	<0.05

a: Fisher's exact probabilities test.

DISCUSSION

Most of SAP mortality is associated with organ failure. In the early courses, organ failure is resulted from inflammatory mediator released by systemic inflammatory response syndrome even if in the absence of infection. In the septic phase, organ failure occurs because of sepsis, so organ failure is common in SAP. Previous study showed that in SAP, organ failure occurred in 72-90.3 %, single organ failure in 24.7-37 %, multiple organ failure in 35-65.6 %. Among the single organ failures, pulmonary failure was the most commonly organ failure (39.1-63 %), followed by cardiovascular failure (23-37.7 %), hepatic failure (20.7 %), renal failure (8.5-13 %)[27,28]. The present data showed that organ failure occurred in 63.5 % (47/74), multiple organ failure in 27.0 % (20/74), single organ failure in 36.5 % (27/74) (Table 2). No relationship existed between organ failure and age, sex, gallstone pancreatitis,

but the severity (APACHE II scores) and mortality were significantly higher in patients with organ failure than in those without organ failure (Table 1). Pulmonary failure was the most common single organ failure (23.0 %, 17/74) in SAP. The mortality rate in patients with single pulmonary failure was 17.6 % (3/17), followed by hepatic and gastrointestinal failure. No patient in this group was accompanied by single renal failure, or cardiovascular organ failure, or encephalic failure (Table 2). Among all the organ failures, pulmonary failure was the most frequent organ failure (45.9 %), the second was multiple organ failure (Table 3).

Conflicting results about the relation between extent of necrosis, infected necrosis and organ failure have been reported[28-31]. The present study demonstrated that although the incidence of organ failure in sterile necrosis was slightly higher than that in infected necrosis (66.0 % *vs* 59.3 %), there was no difference in the prevalence of organ failure in sterile necrosis compared with infected necrosis (Table 4). The incidence of organ failure increased with increased extent of necrosis, but patients with increased amounts of necrosis did not have increased prevalence of organ failure (Table 5).

As to the relation between specific single organ failure and sterile and infected necrosis, previous study showed that the incidence of pulmonary failure was increased in infected necrosis compared with sterile necrosis, and there was no difference in the prevalence of renal failure, cardiovascular failure in infected necrosis compared with sterile necrosis[31]. Our study showed that there was no difference in the prevalence of specific single organ failure in infected necrosis compared with sterile necrosis (Table 6).

The mortality rate was 30 % in patients with multiple organ failure, and was 8 % in those with single organ failure[31]. Our data showed the mortality rate was 45 % (9/20) in patients with multiple organ failure, and was 11 % (3/27) in those with single organ failure (Table 2). Halonen *et al*[32] compared multiple organ dysfunction (MOD) score, sequential organ failure assessment (SOFA) score, and logistic organ dysfunction (LOD) score in predicting hospital mortality rates of 178 SAP patients. The results demonstrated that three different multiple organ dysfunction scores showed good accuracy and were comparable with APACHE II in predicting hospital mortality. In multiple logistic regression analysis, only hepatic, renal, and cardiovascular failures were independent risk factors for hospital mortality. Our study revealed that non survivors had a significantly higher morbidity of multiple organ failure, pulmonary failure, cardiovascular failure and gastrointestinal failure compared with survivors, there was no difference in the morbidity of renal failure, hepatic failure and neurologic failure in nonsurvivors and survivors (Table 7). The results demonstrated that the hospital mortality of SAP was associated with multiple organ failure, pulmonary failure, cardiovascular failure and gastrointestinal failure. Therefore, prophylactic and active treatment of these organ failures are very important in the treatment of SAP. Recently, hemoconcentration (hematocrit $\geqslant$44 % and/or failure of admission hematocrit to decrease at approximately 24 hours)[33,34], plasma concentrations of sTNF-Rs[35], activated polymorphonuclear leucocytes-elastase (PMN-E) and IL-6[36] have been reported as early markers for organ failure and necrotic pancreatitis. Patients coincident with this standard should be treated with strong fluid resuscitation and closely monitored in intensive care units, and new approaches have to be found to counteract these severe complications.

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