Original Article

Factors associated with pancreatic infection in patients with severe acute pancreatitis

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Abstract: Objective: To identify potential risk factors associated with pancreatic infection in severe acute pancreatitis (SAP) patients, thus providing evidence for clinical prediction and treatment. Methods: A total of 42 patients with SAP collected in our hospital from January 2013 to July 2014 were divided into two groups according to the presence or absence of pancreatic infection and retrospectively analyzed. Clinical characteristics and laboratory examine results of the two groups including age, sex, APACHE II score, serum amylase, serum calcium, blood glucose, ALT, AST, hypoxemia, serum albumin, serum creatinine and blood urea nitrogen were investigated for their relevance to pancreatic infection. Results: The overall occurrence of secondary pancreatic infection of the 42 patients was 52.38%. A significantly positive correlation was revealed between the incidence rate of the secondary pancreatic infection and the factors including hypoxemia, blood creatinine and urea nitrogen in SAP patients (P < 0.05 or P < 0.01). Meanwhile, the level of serum albumin was negatively correlated with the rate of secondary infection in SAP patients (P < 0.01). The rest factors showed no significant correlation (P > 0.05). Conclusion: Hypoxemia, blood creatinine and urea nitrogen are potential factors leading to pancreatic infection in SAP patients, while an increase of serum albumin may reduce the incidence of infection.

Keywords: Severe acute pancreatitis, infection, risk factor

Introduction

Acute pancreatitis (AP) is a common disease with an incidence that has been increasing over recent years [1, 2]. AP could present variable severities from being mild and self-limited to severe disease. When developed into severe acute pancreatitis (SAP), it could be very dangerous with various complications and even fatal with a mortality rate of 20~30% [3-5]. In the later period of SAP, more than 80% of the patients died of sepsis and multiple organ dysfunction syndromes (MODS). The occurrence of sepsis and MODS is intimately correlated with the necrosis and secondary infection of pancreas and surrounding tissues, which is the main reason causing death in late SAP patients. Secondary bacterial infection in the devitalized tissue occurs in an estimated 40% to 70% of patients with pancreatic necrosis and is the main determinant of morbidity and mortality from SAP [6, 7]. Therefore, early diagnosis and prediction of secondary infection, especially the infection of necrotic pancreatic tissue is extremely important in the treatment of SAP. Although a number of clinical prognostic scores and serum markers have been reported to assess and monitor AP [8-12], the potential of the various factors to identify patients at risk of developing infected pancreatic necrosis remains unknown. Therefore, it is critically important to identify the risk factors that can predict the development of secondary pancreatic infection in these patients.

This study aims to estimate and identify the risk factors associated with the secondary pancreatic infection in SAP patients. To investigate the relationship between secondary pancreatic infection and potential risk factors, we retrospectively analyzed 42 cases of SAP with the presence or absence of secondary infection and reported the finding as follows. Estimated related factors include Acute Physiology and
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**Materials and methods**

**Patients**

Between January 2013 and July 2014, a total of 42 patients with SAP in our hospital were retrospectively analyzed. The procedure of diagnosis for SAP strictly followed the criteria made by the pancreatic surgery group, Chinese Medical Association. All patients underwent CT examination. Two groups were set according to the presence or absence of pancreatic infection at 2 weeks after the occurring of SAP. The infection group consisted of 22 patients, (male/female = 13/9, average age 51.17 ± 10.57), while the non-infection group included 20 cases (male/female = 1/1, average age 52.43 ± 11.17). There was no significant difference on the gender and age between the two groups (P > 0.05). This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Nanjing Medical University. Written informed consent was obtained from all participants.

**Treatment**

Non-operation therapy were applied on the SAP patients, along with the following measures taken for infection prevention: (1) supplement of blood capacity to improve microcirculation and prevent tissue hypoperfusion damage; (2) preventive use of antibiotics, of which the selection principle was the ability to pass through the blood-pancreatic barrier and act on common intestinal bacteria effectively; (3) correction of hypoxemia; (4) acceleration of the recovery of intestinal function; (5) nutritional support; (6) inhibition of pancreatic secretion including fasting, gastrointestinal decompression and the application of trypsin inhibitors; (7) peritoneal lavage and drainage on patients with excessive peritoneal exudates; (8) drainage through the endoscopic Oddi sphincterotomy for biliary pancreatitis patients with biliary obstruction.

**Criteria for the diagnosis of pancreatic infection**

(1) abdominal symptoms: abdominal pain or tenderness, rebound tenderness, muscle tension or disappearance of borborygms; (2) CT diagnosis of intraperitoneal bubbles or bubbles in peripancreatic lesions; (3) matching of 2 items or more with the following 4 items of the diagnosis standard for total inflammatory reaction syndrome: body temperature > 38°C or < 36°C; heart rate > 90 times/min; respiratory frequency > 20 times/min or PaCO₂ < 4.27 kPa (32 mmHg); white blood cell in peripheral blood > 1.2×10⁹/L or < 0.4×10⁹/L, or immature granular cells > 10%; (4) positive results of bacteria culture of pancreatic necrosis tissue and abdominal pus.

**Analysis of risk factors**

Related factors including APACHE II score, gender, age, blood amylase, blood calcium, blood glucose, ALT, AST, serum albumin, serum creatinine and blood urea nitrogen at the admission of the selected patients were analyzed.

**Statistical analysis**

Statistical analysis was performed using SPSS v17.0 for Windows (SPSS, Inc., Chicago, IL, USA).
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Incidence rate of secondary pancreatic infection

During two weeks after the occurring of SAP, the total incidence rate of pancreatic infection in 42 SAP patients was 52.38% (22/42).

Comparison of factors associated with infection

As revealed in Table 1, the two groups showed no significant difference in APACHE II score, gender, age, blood amylase, blood calcium, blood glucose, ALT and AST at the admission (P > 0.05). The infection group demonstrated higher incidence rate of hyoxemia. Besides, there was significant difference in blood creatinine, serum albumin and urea nitrogen (P < 0.01).

Correlation analysis of risk factors and secondary pancreatic infection

A multiple regression analysis was conducted to reveal the relation between the potential risk factors and infection, considering the risk factors as confounding factors. The result of correlation analysis was displayed in Table 2. A significantly positive correlation was revealed between the incidence rate of the secondary pancreatic infection and the factors including hyoxemia (P < 0.05), blood creatinine (P < 0.01) and urea nitrogen (P < 0.01) in SAP patients. Meanwhile, the level of serum albumin was negatively correlated with the rate of secondary infection in SAP patients (P < 0.01). However, there was no significant correlation between APACHE II score, gender, age, blood amylase, blood calcium, blood glucose, ALT, AST and pancreatic infection.

Discussion

The duration of severe acute pancreatitis depends on the degree of pancreatic and peripancreatic necrosis and the peripancreatic infection status [13-17]. Peripancreatic infection is considered to be responsible for up to 80% of deaths in patients with SAP [4, 18]. During our clinical practice, we have drawn some experiences associated with SAP treatment. Firstly, the late disease (after 2 weeks) death is mainly attributed to peripancreatic infection, or multiple organ dysfunction caused by peripancreatic infection. Therefore reducing the peripancreatic infection is the key to lower the mortality of severe acute pancreatitis. Besides, our result shows that hypoxemia is closely related to pancreatic infection in SAP patients, which is in accordance with another study [19]. Since SAP could cause the damaging of pancreatic microcirculation and insufficient blood perfusion, the hypoxemia can further exacerbate the insufficient of oxygen supply, thus leading to pancreatic necrosis. Therefore, respiratory function should be improved to increase the blood oxygen concentration and saturation for correcting acidosis, in order to improve the oxygen carrying function of red blood cells. Meanwhile, fresh blood should be transfused appropriately to improve microcirculation. Renal insufficiency is another leading cause of pancreatic infection. The infection

Table 2. Correlation analysis of risk factors and secondary pancreatic infection

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Regression coefficient (B)</th>
<th>Standard error (s)</th>
<th>Standardized partial regression coefficient (b')</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE II score</td>
<td>0.196</td>
<td>0.057</td>
<td>0.200</td>
<td>1.426</td>
<td>0.125</td>
</tr>
<tr>
<td>Blood amylase</td>
<td>0.097</td>
<td>0.040</td>
<td>0.131</td>
<td>0.826</td>
<td>0.381</td>
</tr>
<tr>
<td>Gender</td>
<td>0.133</td>
<td>0.053</td>
<td>0.156</td>
<td>1.082</td>
<td>0.284</td>
</tr>
<tr>
<td>Age</td>
<td>0.178</td>
<td>0.065</td>
<td>0.202</td>
<td>1.430</td>
<td>0.131</td>
</tr>
<tr>
<td>Hyoxemia</td>
<td>0.242</td>
<td>0.057</td>
<td>0.275</td>
<td>2.083</td>
<td>0.041</td>
</tr>
<tr>
<td>AST</td>
<td>0.174</td>
<td>0.061</td>
<td>0.214</td>
<td>1.638</td>
<td>0.102</td>
</tr>
<tr>
<td>ALT</td>
<td>0.171</td>
<td>0.063</td>
<td>0.222</td>
<td>1.643</td>
<td>0.103</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>0.103</td>
<td>0.069</td>
<td>0.141</td>
<td>0.941</td>
<td>0.311</td>
</tr>
<tr>
<td>Blood calcium</td>
<td>0.135</td>
<td>0.064</td>
<td>0.172</td>
<td>1.275</td>
<td>0.202</td>
</tr>
<tr>
<td>Blood creatinine</td>
<td>0.327</td>
<td>0.057</td>
<td>0.400</td>
<td>3.122</td>
<td>0.002</td>
</tr>
<tr>
<td>Urea nitrogen</td>
<td>0.297</td>
<td>0.059</td>
<td>0.379</td>
<td>2.831</td>
<td>0.005</td>
</tr>
<tr>
<td>Serum albumin</td>
<td>-0.241</td>
<td>0.060</td>
<td>-0.272</td>
<td>2.024</td>
<td>0.042</td>
</tr>
</tbody>
</table>

USA). Values were expressed as mean ± standard deviation (SD). All continuous variables were analyzed by using student’s t test or t’ test. Categorical variables were analyzed with the chi-square test or corrected chi-square test.
mechanism may be concluded as follows. When renal insufficiency occurs, the leukocyte chemotaxis is damaged, leading to impaired neutrophil function. Lymphocyte decrease and dysfunction also result in impaired immune function. Besides, the malnutrition and a large amount of protein in the urine can lead to a decrease of various proteins in vivo (including immune globulin), making it easier for infection. We also found that low level of serum albumin is an important factor resulting in infection. Albumin is the major immune protein in the human body. A low serum albumin level can lead to decreased immunity, hence reducing the anti infection ability of patients. Therefore, the level of serum albumin is also a good indicator for the measurement of the general condition in SAP patients. For SAP patients with impaired renal function, the treatment should be focused on the remission of renal dysfunction and the clearance of toxins and inflammatory medium to reduce the systemic inflammatory response and improve the general condition of the patients, thus avoiding the occurrence of infection.

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Disclosure of conflict of interest

None.

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References

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