Risk factors of infected pancreatic necrosis secondary to severe acute pancreatitis

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BACKGROUND: Severe acute pancreatitis (SAP) remains a clinical challenge with considerable morbidity and mortality. An early identification of infected pancreatic necrosis (IPN), a life-threatening evolution secondary to SAP, is obliged for a more preferable prognosis. Thus, the present study was conducted to identify the risk factors of IPN secondary to SAP.

METHODS: The clinical data of patients with SAP were retrospectively analyzed. Univariate and multivariate logistic regression analyses were sequentially performed to assess the associations between the variables and the development of IPN secondary to SAP. A receiver operating characteristic (ROC) curve was created for each of the qualified independent risk factors.

RESULTS: Of the 115 eligible patients, 39 (33.9%) progressed to IPN, and the overall in-hospital mortality was 11.3% (13/115). The early enteral nutrition (EEN) (*P*=0.0092, OR=0.264), maximum intra-abdominal pressure (IAP) (*P*=0.0398, OR=1.131) and maximum D-dimer level (*P*=0.0001, OR=1.006) in the first three consecutive days were independent risk factors associated with IPN secondary to SAP. The area under ROC curve (AUC) was 0.774 for the maximum D-dimer level in the first three consecutive days and the sensitivity was 90% and the specificity was 58% at a cut-off value of 933.5 μg/L; the AUC was 0.831 for the maximum IAP in the first three consecutive days and the sensitivity was 95% and specificity was 58% at a cut-off value of 13.5 mmHg.

CONCLUSIONS: The present study suggested that the maximum D-dimer level and/or maximum IAP in the first three consecutive days after admission were risk factors of IPN secondary to SAP; an EEN might be helpful to prevent the progression of IPN secondary to SAP.

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KEY WORDS: D-dimer;
enteral nutrition;
infected pancreatic necrosis;
intra-abdominal pressure;
risk factor;
severe acute pancreatitis

Introduction

Acute pancreatitis (AP) is an inflammation of the pancreas and can generate severe local and/or systemic complications. Approximately 20% of patients with AP eventually progress to severe AP (SAP), which is characterized by persistent (>48 hours) organ failure.[1] Pancreatic necrosis is a severe evolution during the natural course of SAP. The mortality rate is 43% for the patients who have infected pancreatic necrosis (IPN) and organ failure.[2]

Few publications provide precise and adequate early predictions of the outcomes of SAP, including the development of IPN.[3-5] Therefore, the present study was to identify the early-phase baseline parameters that were associated with the development of IPN secondary to SAP.

Methods

Patient selection

Consecutive adult patients with SAP (age ≥18 years old) admitted to the Department of Pancreatic and Biliary Surgery, First Affiliated Hospital of Harbin Medical University between January 2009 and December 2013 were enrolled. The exclusion criteria for patients are shown in a flow chart (Fig. 1), and the included patients were followed up for 90 days after discharge. The study was approved by the Ethics Committee of our hospital.

Definition

According to the modified Atlanta Criteria,[1] AP was diagnosed based on the presence of at least two of the following three criteria: (1) an initial serum amylase and/

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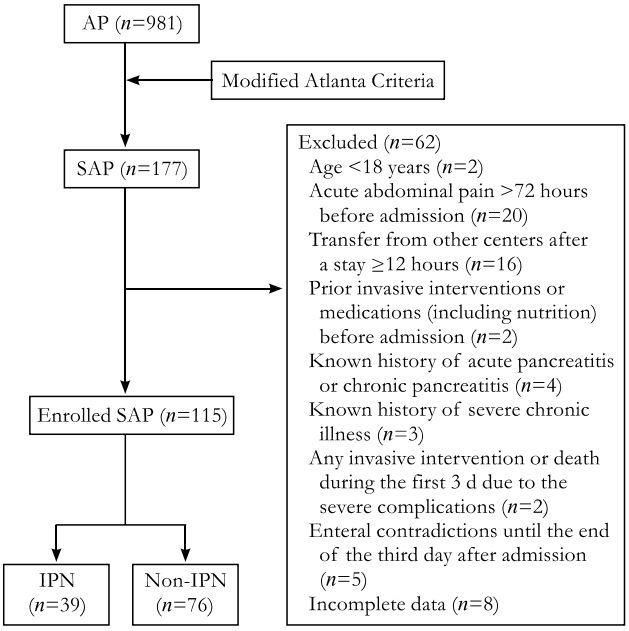

Fig. 1. Flow chart of patients with SAP between January 2009 and December 2013. AP: acute pancreatitis; SAP: severe acute pancreatitis; IPN: infected pancreatic necrosis.

or lipase level at least three-fold above the normal upper limit; (2) typical abdominal pain consistent with AP; and (3) suggestive imaging evidence compatible with AP. SAP was defined as AP accompanied by the persistent organ failure. To exclude any iatrogenic factors that might incur infections, the IPN investigated in the present study was defined as any infection of the necrotic pancreatic parenchyma or peripancreatic collections that developed prior to any invasive intervention. The presence of IPN was suspected if the patient had a continuous fever and/or general deterioration despite the appropriate management, and IPN was confirmed by computed tomography (CT). Microbiological confirmations were established with positive cultures of samples obtained by fine needle aspirations under CT/ultrasound guidance and/or samples obtained during invasive therapeutic procedures.

Clinical management protocol

Immediately after admission, all patients received individualized conservative therapy for SAP that included intensive monitoring, fluid resuscitation, oxygen administration, fasting, analgesia and suppression of pancreatic exocrine function. Additionally, antibiotics were prescribed in the presence of other infections (e.g., biliary tract, urinary tract, pulmonary, etc.) in the setting of SAP. Contrast-enhanced CT was routinely performed on the third day after admission or earlier when warranted by diagnostic dilemmas.

Intra-abdominal pressure (IAP) was measured with the following technique. All patients were told to remain in a complete supine position after bladder empting; then, 25 mL of sterile saline was instilled through a Foley catheter into the bladder. The indices were scaled at the end-expiration without any abdominal muscle contraction and calculated (1 mmHg=1.36 cmH_2O) using the mid-axillary line as the zero reference point. The IAP was measured at admission and every 12 hours thereafter for initial consecutive five to seven days. The time interval was shortened to 6 hours or 3 hours if intra-abdominal hypertension (IAH, defined as a persistent increase of IAP >12 mmHg) or acute compartment syndrome (ACS, defined as sustained IAP >20 mmHg combined with new onset organ failure) was detected.[6]

Endoscopic nasojejunal tubes were selectively inserted beyond the ligament of Treitz within the first 24-48 hours after admission, and the position of the tip was confirmed by fluoroscopy. During the next 24 hours, enteral nutrition (EN) using a small peptide medium-chain triglyceride semi-elemental formula was commenced and gradually increased. The total calories required were calculated as 25-30 kcal/kg per day, and the protein needs were calculated as 1.25-1.50 g/kg per day. Early EN (EEN) was defined as the patient tolerated at least 70% of his or her daily required calories at the third day after admission. Total parenteral nutrition was only initiated in response to EN contradictions, intolerance or insufficient delivery (failure to provide >60% of the daily required calories after 7 days). Once IPN was confirmed, a minimally invasive procedure or a laparotomy was performed as soon as possible. Additionally, antibiotic therapies were guided by the results of culture and sensitivity.

Data collection

The following data were collected from all eligible patients: (1) demographic data, including age, gender, etiology and body mass index (BMI); and (2) the maximum value for the following clinical data within the first 3 days: white blood cell count, hematocrit, platelet count, C-reactive protein, blood urea nitrogen, creatinine, D-dimer, IAP, sequential organ failure assessment score, modified Marshall score and acute physiology and chronic health evaluation II score. The CT severity index (CTSI) at the third day, the Imrie score at the end of second day and an indicator of whether each patient could successfully undergo EEN were also documented.

Statistical analyses

The data were analyzed using SAS 9.1 for Windows (SAS Institute, Cary, NC, USA). Quantitative variables were presented as the median (interquartile range, IQR) in cases of non-normal distributions or as mean±standard deviation for normal distributions. Categorical variables