Study on application of spiral CT perfusion technology in the diagnosis of acute pancreatitis

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Objective: To explore the application value of spiral CT perfusion technology in the diagnosis of acute pancreatitis (AP).

Methods: A total of 78 patients with AP who were admitted in our hospital from September, 2014 to September, 2016 were included in the study. The velocity method was used to detect S-Amy and U-Amy. The emulsion enhancement velocity scattering turbidimetry was used to detect CRP. ELISA was used to detect D-D. The patients in the control group were performed with abdomen CT, while AP patients were performed with 64 slice spiral CT. The most integrated layer of pancreas display was regarded as the perfusion weighted imaging scanning layer, and CT perfusion scanning was performed. BF, BV, MTT, and PS were calculated.

Results: S-Amy, U-Amy, CRP, and D-D in AP patients were significantly higher than those in the control group. With the disease progression, S-Amy and U-Amy were significantly reduced, while CRP and D-D were significantly elevated. BF and BV in AP patients were significantly lower than those in the control group, and those in SAP patients were significantly lower than those in MAP patients. With the elevation of CT grading, BF and BV were significantly reduced, while the comparison of MTT and PS among the various grading was not statistically significant.

Conclusions: The pancreas perfusion in AP patients is in a low perfusion state. BF and BV are negatively correlated with the severity degree of AP, which can predict the prognosis. BF and BV in combined with the serum S-Amy, U-Amy, CRP, and D-D can provide a forceful evidence for the diagnosis, treatment, and condition evaluation of AP.

1. Introduction

Acute pancreatitis (AP) refers to that due to various reasons, the activated pancreatin can cause edema, hemorrhage, and necrotic inflammatory reaction in the pancreatic tissues, and is one of the acute abdomens in the clinic[1]. Due to the rapid progression and various complications, no timely diagnosis and treatment can promote AP develop into the severe acute pancreatitis (SAP), inducing the complications of pseudocyst, pancreatic necrosis, infectious shock, and multiple organ failure, which can endanger the patient’s life[2]. CT perfusion technology can quantitatively describe the vivisection infusion through intravenous bolus injection of contrasting agents to obtain the blood perfusion data in order to reflect the physiological function of tissues[3]. The study is aimed to explore the application value of spiral CT perfusion technology in the diagnosis of AP.

2. Materials and methods

2.1. Clinical materials

A total of 78 patients with AP who were admitted in our hospital from September, 2014 to September, 2016 were included in the study, among which 47 were male, and 31 were female; aged from 26 to 67 years old; 45 had MAP, and 33 had SAP; 19 in grade A, 14 in grade B, 12 in grade C, 18 in grade D, and 15 in grade E according to CT grading. All the patients were in accordance with
the related diagnostic criteria of AP [4]. Moreover, 26 individuals with normal pancreas by abdomen CT were served as the control group, among which 15 were male, and 11 were female; aged from 27 to 65 years old. The comparison of gender and age among all the subjects were not statistically significant (P>0.05).

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Those who had no heart and large vascular disease which can affect the normal blood perfusion of pancreas; (2) Those who had no obvious heart, liver, and renal dysfunction, advanced tumor, and coagulation disorders; (3) Those who had no history of iodine allergy; (4) Those who had signed the informed consents. Exclusion criteria: (1) Those who were unable to be performed with CT perfusion or not coordinated with the examiners; (2) Those who were merged with other pancreatic diseases; (3) Those who had incomplete materials and detachment.

2.3. Detection of biochemical indicators

The morning fasting elbow venous blood was collected, and centrifuged at 3 000 r/min for 10 min. The supernatant was extracted for inspection. The fresh urine was remained for inspection. The velocity method was used to detect S-Amy and U-Amy. The emulsion enhancement velocity scattering turbidimetry was used to detect CRP. ELISA was used to detect D-D.

2.4. CT examination

The patients in the control group were performed with abdomen CT, while AP patients were performed with 64 slice spiral CT (produced by GE). The most integrated layer of pancreas display was regarded as the perfusion weighted imaging scanning layer. The automatic high-pressure injector was used for the injection of iohexol (50 mL) through the anterior elbow venous channel, with flow rate of 4 mL/s. 6 s after injection, CT perfusion scanning was performed, with tube voltage of 120 kV, tube current of 60 mA, matrix of 512x512, thickness of 5 mm, rotation time of 1 time/s, and scanning time of 30 s. During the examining process, the patients were told to hold their breaths. The layer with clear pancreas display and less artifact was selected, and the images were processed by the radiological technologists. CT Perfusion 4 software was used to process the best images in the same layer, with threshold rang of -20-200 HU. According to the reference value, i.e. 40%-60% of abdominal aorta CT value, the infiltration processing was performed. Deconvolution was used to calculate BF, BV, MTT, and PS.

2.5. Statistical analysis

SPSS 19.0 software was used for the statistical analysis. The measurement data were expressed as mean ± SD, and t test was used. Chi-square test was used for the enumeration data. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the biochemical indicators among patients with AP in different degrees

S-Amy, U-Amy, CRP, and D-D in AP patients were significantly higher than those in the control group (P<0.05). With the disease progression, S-Amy and U-Amy were significantly reduced (P<0.05), while CRP and D-D were significantly elevated (P<0.05) (Table 1).

3.2. Comparison of pancreas CT perfusion parameters among patients with AP in different degrees

BF and BV in AP patients were significantly lower than those in the control group (P<0.05). With the disease progression, BF and BV were significantly reduced (P<0.05), while the comparison of MTT and PS between AP patients and the control group was not statistically significant (P>0.05) (Table 2).

3.3. Comparison of perfusion parameters among AP patients with different CT grading

With the elevation of CT grading, BF and BV were significantly reduced (P<0.05), while the comparison of MTT and PS among the various grading was not statistically significant (P>0.05) (Table 3).

Table 1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>S-Amy</th>
<th>U-Amy</th>
<th>CRP</th>
<th>D-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>26</td>
<td>75.43±6.58</td>
<td>178.45±26.78</td>
<td>12.15±3.27</td>
<td>0.17±0.04</td>
</tr>
<tr>
<td>MAP</td>
<td>45</td>
<td>879.63±67.72*</td>
<td>1327.52±126.41*</td>
<td>96.58±32.19*</td>
<td>0.65±0.28*</td>
</tr>
<tr>
<td>SAP</td>
<td>33</td>
<td>848.54±78.57*#</td>
<td>1074.51±201.64*#</td>
<td>165.25±39.82*#</td>
<td>2.47±0.79*#</td>
</tr>
</tbody>
</table>

*P<0.05, when compared with the control group; #P<0.05, when compared with MAP.

Table 2.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>BF</th>
<th>BV</th>
<th>MTT</th>
<th>PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>26</td>
<td>118.46±28.75</td>
<td>24.37±3.46</td>
<td>8.24±1.29</td>
<td>33.16±12.34</td>
</tr>
<tr>
<td>MAP</td>
<td>45</td>
<td>93.17±23.24*</td>
<td>17.61±4.29*</td>
<td>7.51±1.86</td>
<td>35.17±12.12</td>
</tr>
<tr>
<td>SAP</td>
<td>33</td>
<td>60.45±13.52*#</td>
<td>7.27±2.15*#</td>
<td>7.37±2.12</td>
<td>40.08±11.43</td>
</tr>
</tbody>
</table>

*P<0.05, when compared with the control group; #P<0.05, when compared with MAP.
4. Discussion

After pancreatic damage, a large amount of amylase secreted by the pancreas tissues are released into the blood, and reabsorbed through renal tubular filtration, resulting in significant elevation of urine amylase concentration[5]. Some researches demonstrate that S-Amy begins to raise 6-12 h after AP attack, and begins to reduce after 2-day elevation[6,7]. If S-Amy exceeds more than 3 times of the reference value, the diagnosis of AP is supported. While U-Amy is gradually elevated 12-14 h after attack, continuously for 1-2 weeks. CRP is a non-specific marker of systemic inflammatory reaction or damage, and is also a suggestive marker of early microcirculation disturbance, whose level can be elevated to 18-20 times of normal value when there is an infection or pancreatic necrosis caused by microcirculation disturbance, which is of great significance in detecting the severe complications[8]. Some researches demonstrate that the large amount of pancreas secretion, sphacelus, and inflammatory reaction in patients with ASP can damage the vascular endothelial function, resulting in CRP level higher than that in MAP and normal individuals, suggesting that CRP has an important value in predicting the severity degree of AP[9]. Due to hypercoagulation, reduced coagulation factors, and increased fibrin degradation products in patients with SAP, the secondary hyperfibrinolysis is produced, while D-D is a specific product of cross-linking fibrin degradation, and can accurately reflect the fibrinolysis function[10]. The results in the study showed that S-Amy, U-Amy, CRP, and D-D in AP patients were significantly higher than those in the control group (P<0.05); with the disease progression, S-Amy and U-Amy were significantly reduced (P<0.05), while the comparison of MTT was significantly reduced (P<0.05), indicating that the microcirculation disturbance plays a vital role in the onset and progression of AP, and is more serious in SAP patients, with significantly reduced perfusion.

In conclusion, the pancreas perfusion in AP patients is in a low perfusion state. BF and BV are negatively correlated with the severity degree of AP, which can predict the prognosis. BF and BV in combined with the serum S-Amy, U-Amy, CRP, and D-D can provide a forceful evidence for the diagnosis, treatment, and condition evaluation of AP.

References