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Original Research Article

Combined effect of ultrasound-guided percutaneous abdominal paracentesis drainage and ulinastatin on severe acute pancreatitis

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Abstract

Purpose: *To study the clinical effect of a combination of ultrasound-guided percutaneous abdominal paracentesis drainage (APD) and ulinastatin on severe acute pancreatitis (AP).*
Methods: *A total of 94 patients with severe AP in Intensive Care Unit, Jiaozhou Central Hospital, Qingdao, from December 2017 to December 2018 were selected as the research subjects. They were divided into control and study groups, with 47 patients in each group. Patients in the control group underwent laparotomy drainage, while patients in the study group underwent ultrasound-guided percutaneous APD. Patients in both groups received ulinastatin perfusion. Subsequently, clinical effects and other relevant indicators were determined.*
Results: *Overall response was significantly higher in the study group than in the control group ($p < 0.05$). The times taken for disappearance of postoperative symptoms, normalization of serum amylase level, and hospitalization were significantly shorter in the study group than in the control group ($p < 0.05$). For every indicator, the study group exhibited more benefits after than before treatment; however, post-treatment levels of blood glucose, hemodiastase and urinary amylase were better than those in the control group ($p < 0.05$). Incidence of postoperative complications was lower in the study group than in control group ($p < 0.05$).*
Conclusion: *The combination of ultrasound-guided percutaneous APD with ulinastatin produces marked beneficial effects on severe AP patients. It facilitates the remission of adverse symptoms, and enhances normalization of indicator levels. Moreover, it displays low incidence of complications, better prognosis and recovery, and absence of post-operation infections.*

Keywords: *Ultrasound-guided, Percutaneous abdominal paracentesis drainage, Ulinastatin, Severe acute pancreatitis*

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INTRODUCTION

Acute pancreatitis (AP) is a frequently reported acute abdominal condition in which the activation of pancreatic enzymes due to certain factors triggers self-digestion, hemorrhage, edema or necrosis of the pancreatic tissue. It presents mainly as localized inflammation of the pancreas, with or without functional impairment of other organs [1-4]. It is characterized clinically by acute

epigastric pain, and elevated lipase and amylase in blood and urine. Reports have shown that more than 80% of AP patients experience mild pancreatitis, but show good prognosis through effective therapies. About 10% of patients develop severe AP, also known as acute hemorrhagic necrotizing pancreatitis (AHNP), which is non-reversible and requires surgical treatment. Furthermore, mild pancreatitis leads to severe AP if not treated in time [5-7].

With constant improvement in social living standards, and changes in people's dietary habits, the incidence of AP has remained high in recent years, and clinical studies on the disease have been intensified as well. Conservative treatment, minimally invasive therapy and laparotomy are combined in the treatment of severe AP. While conservative treatment is suitable for patients with mild condition, it is often difficult to use it to handle the underlying cause for patients with severe conditions. On the other hand, laparotomy is traumatic to patients, and it produces many prognostic complications which are detrimental to their prognosis and recovery. In contrast, minimally invasive surgery is less traumatic, reduces pancreatic duct pressure and surgical risk, and is more acceptable. Based on these factors, 94 patients with severe pancreatitis admitted to our hospital were selected for an in-depth study so as to analyze the clinical effects of combination of ultrasound-guided percutaneous abdominal paracentesis drainage (APD) and ulinastatin on severe AP.

METHODS

General information on patients

In this study, 94 patients with severe AP in Intensive Care Unit, Jiaozhou Central Hospital, Qingdao, from December 2017 to December 2018 were selected as subjects. They were divided into control group (n = 47) and study group (n = 47) using the random number table method. The control group consisted of 43 male and 4 female patients who were aged 39 - 69 years (mean age = 46.3 ± 4.5 years). There were 20 cases of biliary pancreatitis, 14 cases of alcoholic pancreatitis, and 13 cases of pancreatitis with other etiologies. The study group consisted of 44 male and 3 female patients aged 38 - 71 years (mean age = 47.1 ± 4.6 years). This group had 18 cases of biliary pancreatitis, 15 cases of alcoholic pancreatitis, and 14 cases of pancreatitis due to other causes. There were no statistically significant differences in general data of patients between the two groups ($p > 0.05$).

Inclusion criteria

Patients in the following categories were included**:** those who were diagnosed with severe AP based on their clinical symptoms, imaging examinations such as enhanced CT and MR, and laboratory results; patients who were first diagnosed in our hospital or treated in other hospitals without paracentesis drainage and antibiotics, and patients with complete medical records. The study received approval from the Ethics Committee of Jiaozhou People's Hospital (approval no. 2017-KY-2584). Patients and their families were aware of the purpose and protocols involved in the study prior to their acceptance of the treatment regimens, and each of them signed informed consent form. The protocol in this study followed the World Medical Association Declaration of Helsinki [8].

Exclusion criteria

Patients in the following categories were excluded: those with AP secondary to other diseases, or AP induced by certain drugs; patients who previously underwent endoscopic surgery; patients who underwent retroperitoneal necrotic tissue removal after ultrasound-guided percutaneous APD; those who had other pancreatic diseases, and patients who suffered from mental and other cognitive impairments, as well as those who were uncooperative with experimental personnel.

Treatments

Preoperatively, vital signs in patients were recorded, water and food deprivation were adopted, imbalances in their body indicators were regulated, and oxygen and gastric decompression were given. Appropriate medications such as anti-secretory agents and sedatives were administered, based on disease manifestations, and parenteral nutrition intervention was also used.

Patients in the control group underwent laparotomy drainage. Preoperative examination was carried out. Specific lesions were examined with laparotomy, and the pancreatic lesions were either removed, or the capsule of pancreas was cut, depending on the actual situation. Removal of exudate and diseased tissue from the peritoneum was followed by placing multiple tubes on the peritoneum and posterior peripancreatic area for drainage operation. Postoperatively, the abdominal cavity of each patient was flushed with sterile saline every 6 - 8 h, and their postoperative conditions, drainage fluid volume and other indicators were recorded.

Postoperative gastric decompression was promptly performed, parenteral nutrition intervention was given, as well as postoperative treatments with proton pump inhibitors and pancreatic enzyme inhibitors. Antibiotics were administered to prevent postoperative infection.

Patients in the study group underwent ultrasound-guided percutaneous APD. Ultrasound guidance was performed using a SuperSonic Imagine Aixplorer (SC6-1 convex array probe with a frequency of 2 - 5 MHz), with a disposable drainage catheter of size of 8-16F. The puncture route and site were selected under ultrasound guidance. A drainage tube (14F - 16F) was placed after puncture, and necrotic tissue fluid-like material was withdrawn for bacterial susceptibility test and amylase assay. On the second postoperative day, the abdominal cavity of each patient was flushed with sterile saline every 6 - 8 h for 3 days, to remove solid necrotic tissues. Thereafter, the drainage effect was evaluated, and the drainage was continued for 2 - 4 more weeks if necessary, during which their drainage tubes and changes in condition were observed. Patients were extubated when the drainage fluid became much clearer and the amylase index was normal [9-11]. After extubation, the patients were observed for recurrence of disease.

All patients were catheterized via the femoral artery to the regional artery of the pancreas using the Seldin-ger method under X-ray guidance. Then, the catheter was fixed and connected to a micro-pump, followed by perfusion with 100,000 U of ulinastatin (10 IU/vial, product of TECHPOOL, NMPA approval number H19990134) dissolved in 100 mL of physiological saline. Perfusion was carried out for about 5 h daily for a total of 21 days.

Criteria for efficacy determination, and observation indicators

The efficacy of each treatment was evaluated and classified as *ineffective*, *effective*, or *significant*. Treatment efficacy was deemed *significant* if adverse symptoms disappeared completely; imaging examination showed normal pancreas, and related marker test results and vital signs showed normal results. If the adverse symptoms were reduced and vital signs were improved, and the test indices were resolved, the treatment efficacy was assumed to be *effective.* However, treatment efficacy was classified as *ineffective* if the condition of the patient did not improve at all, or if it deteriorated, requiring laparotomy, or if the patient died. The total response was obtained by summing up cases of *significant* and *effective*.

The basic conditions during the perioperative period and the occurrence of postoperative adverse reactions in both groups were recorded. The test indices of the two groups were compared.

Statistical analysis

The SPSS 20.0 was used to analyze the study data, while GraphPad Prism7 (GraphPad Software, San Diego, USA) was used to carry out graphical analysis. Enumeration data and measurement data were analyzed using X^2 test, *t*-test and normality test, as appropriate. $P < 0.05$ was taken as indicative of statistically significant difference.

RESULTS

Therapeutic effects

Total response was significantly higher in the study group than in the control group *(*$p < 0.05$; Table 1). The typical intraoperative ultrasonograms of patients is displayed in Figure 1.

Postoperative basic conditions

The time taken for symptom disappearance, time taken before serum amylase was normalized, and duration of hospital stay were shorter in the study group than in the control group. These results are shown in Figure 3.

Table 1: Comparison of therapeutic effects in both groups [n (%)]

Group	Ineffective	Effective	Significant	Overall response
Study (n=47)	2 (4.26)	14 (29.79)	31 (65.95)	45 (95.74)
Control (n=47)	13 (27.66)	19 (40.43)	15 (31.91)	34 (72.34)
χ^2				9.5983
P-value				0.002

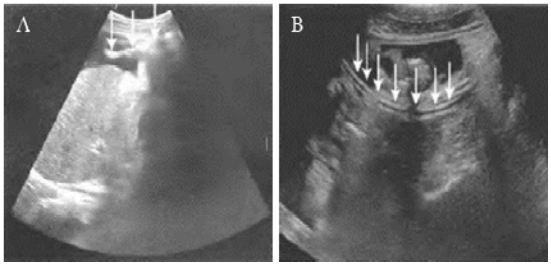

Figure 1: Ultrasound-guided image of a patient with acute pancreatitis. Figure 1A: male, 52-year-old, perihepatic puncture, puncture needle shown by arrow; Figure 1B: female, 62-year-old, drainage tube shown *by* arrow

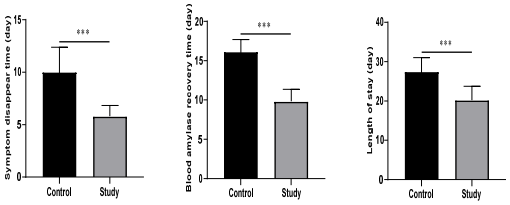

Figure 3: Postoperative basic conditions. N***ote:*** ****P* <0.001

Test indicators

Table 2 shows that on every indicator, the study group had markedly more advantage after treatment than before treatment, and post-treatment levels of blood glucose, hemodiastase and urinary amylase in the study group were markedly better than those in the control group (*p < 0.05)*.

Postoperative complications

There were lower incidences of postoperative complications in the study group than in the control group ($p < 0.05$; Table 3).

DISCUSSION

At the early stage of the onset of severe AP, pathogenic factors activate pancreatic enzymes and release endotoxins and inflammatory factors, resulting in local inflammation in patients. As the disease spreads, the inflammatory factors stimulate more inflammatory reactions, triggering severe physical discomfort in patients [12-15].

The major focus of clinical therapy is on alleviation of symptoms of the disease by removing pancreas-derived toxins and inflammatory factors. Traditional surgical procedures not only fail to prevent pathological changes, but also increase the risk of postoperative infection, and in some cases, may lead to severe metabolic disorders. Percutaneous puncture with drainage placement is an emerging minimally invasive procedure which drains necrotic tissue fluids from the abdominal cavity, reduces pressure, inhibits bacterial proliferation, and prevents toxin absorption, thereby effectively providing relief to the patient. Ulinastatin, a popular drug used in the treatment of pancreatitis, is essentially a broad-spectrum protease inhibitor that stabilizes the lysosomal membrane and blocks the release of inflammatory factors, thereby effectively improving immunity and protecting tissues and organs [16-18].

In this study, 94 patients with severe pancreatitis admitted to our hospital were selected as subjects for studying and analyzing the clinical

Table 2: Comparison of indicators between the two groups (mean ± SD)

Group	Control group (n=47)		Study group (n=47)	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Blood calcium (mmol/L)	1.94±0.48	2.27±0.62*	1.93±0.46	2.36±0.68*
Blood glucose (mmol/L)	10.55±1.82	6.92±1.48*	10.59±1.79	5.45±1.18*#
Hemodiastase (U/L)	637.46±49.73	160.38±43.25*	633.72±47.62	95.46±10.62*#
Urine amylase (U/L)	1275.63±168.35	687.74±59.21*	1283.46±163.58	403.71±49.02*#
WBC count ($\times 10^9$)	15.43±4.58	7.53±1.25*	15.46±4.52	7.44±1.33*

Note: **P* <0.05 when compared to pre-treatment; *#p* <0.05 when compared to control group

Table 3: Comparison of postoperative complications

Group	Control (n=47)	Study (n=47)	χ^2	*P*-value
Abdominal infection	2 (4.26)	1 (2.13)		
Pancreatic inactivity	2 (4.26)	1 (2.13)		
Bleeding	1 (2.13)	1 (2.13)		
Pancreatic cyst	1 (2.13)	0 (0)		
Acute fluid accumulation	3 (6.38)	0 (0)		
Pancreatic necrosis	3 (6.38)	0 (0)		
Overall incidence	12 (25.53)	3 (6.38)	6.425	0.011

effect of combination of ultrasound-guided percutaneous APD and ulinastatin on severe AP. The results indicated that the study group had significantly higher overall response with respect to postoperative disappearance of symptoms, normalization of serum amylase, and shorter duration of hospitalization, when compared to the control group. For every indicator, the study group had markedly better outcomes after treatment than before treatment. Blood glucose, hemodiastase and urine amylase after treatment in the study group were markedly lower than those in the control group, and incidents of postoperative complications were lower in the study group than the control group.

The results of this study are consistent with a previous report which showed that ultrasound-guided percutaneous APD significantly improved the recovery of severe AP patients, reduced the degree of organ damage and duration of hospitalization, and accelerated recovery, thereby exhibiting high efficacy and clinical value [17]. These findings provide further evidence of the clinical effect of combination treatment using ultrasound-guided percutaneous APD and ulinastatin for severe AP.

CONCLUSION

The combination of ultrasound-guided percutaneous APD and ulinastatin for treatment of severe AP produces marked clinical effect. It shows low trauma, and reduces the risk of surgery, facilitates the remission of adverse symptoms in patients, and enhances quick normalization of the levels of indicators. Moreover, it minimizes post-operative infection, reduces incidence of complications, and produces better prognosis and recovery.

DECLARATIONS

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Conflict of interest

The authors declare that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

Contribution of authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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