

# Treatment of severe acute pancreatitis through retroperitoneal laparoscopic drainage

Chun Tang\*, Baolin Wang\*, Bing Xie, Hongming Liu, Ping Chen (✉)

Department of Hepatobiliary Surgery, Research Institute of Surgery, Daping Hospital, Third Military Medical University, Chongqing 400042, China

© Higher Education Press and Springer-Verlag Berlin Heidelberg 2011

**Abstract** A treatment method based on drainage via retroperitoneal laparoscopy was adopted for 15 severe acute pancreatitis (SAP) patients to investigate the feasibility of the method. Ten patients received only drainage via retroperitoneal laparoscopy, four patients received drainage via both retroperitoneal and preperitoneal laparoscopy, and one patient received drainage via conversion to laparotomy. Thirteen patients exhibited a good drainage effect and were successfully cured without any other surgical treatment. Two patients had encapsulated effusions or pancreatic pseudocysts after surgery, but were successfully cured after lavage and B ultrasound-guided percutaneous catheter drainage. SAP treatment via retroperitoneal laparoscopic drainage is an effective surgical method, resulting in minor injury.

**Keywords** severe acute pancreatitis (SAP); laparoscope; retroperitoneal drainage; treatment

## Introduction

Severe acute pancreatitis (SAP) is a clinically common acute and critical disease with a high mortality rate. Disputes over its treatment, especially the indications for surgical treatment, as well as operative opportunity and method, are continuous. Currently, the main treatment program is still inclined to conservative techniques at the early stage, and removal of the pancreas and surrounding necrotic tissues at the later stage. The main purpose and method of surgical treatment are the “removal of the necrotic tissue of pancreas, open drainage, and big flow lavage” [1]. However, in recent years, a new theory stating that the incidence of pancreatitis is related to microcirculatory disturbance and high pressure in multiple compartments has emerged. Hence, the main purpose of surgical treatment of pancreatitis has evolved from the traditional removal of necrotic tissue into pressure reduction and drainage. A prompt and effective drainage of hydrops in the abdominal cavity can reduce the intra-abdominal pressure and improve the microcirculation in the pancreatic tissue, thereby effectively improving the healing of SAP.

At present, the SAP drainage methods mainly include laparotomy via a preperitoneal approach using a laparoscope, a B ultrasonic-guided puncture catheter, among others. However, these drainage methods have disadvantages such as creation of a large wound, infection induction or aggravation, or poor drainage effect. Our department has treated 15 SAP patients via the retroperitoneal laparoscopic drainage since June 2008 and has achieved good results.

## Data and methods

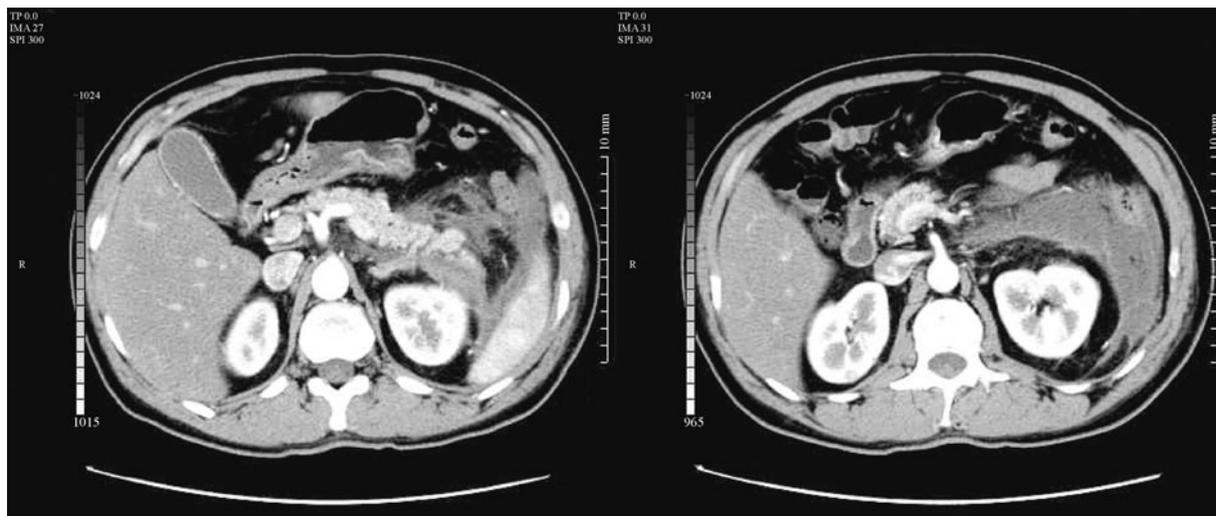
### Clinical data

The 15 cases used in the current study consist of nine males and six females. The minimum age is 32 years and the maximum age is 66 years; the average age is  $41.2 \pm 14.8$  years. Their main symptoms are pain in the middle and upper abdomen, with some patients presenting with shivering and fever. Computed tomography (CT) shows that all patients have hydrops around the pancreas and in the abdominal cavity (Fig. 1). The surgery time is two days to three weeks after the incidence. The surgical method is retroperitoneal laparoscopic drainage through the left waist. Some cases also receive drainage via the preperitoneal approach. If the laparoscopic surgery is difficult, the method is switched to drainage via laparotomy.

Received April 7, 2011; accepted June 29, 2011

Correspondence: chenping@263.net

\*These two authors contributed equally to this study.



**Fig. 1** A 44-year-old male patient was hospitalized on July 27, 2009 after he suffered from pain in the upper abdomen. The results of his physical examination are as follows: a slight abdominal bulge, full left abdomen, pressing and jumping pain and muscular tension in the upper abdomen, positive shifting dullness, and weakened bowel sound. A routine blood examination showed a WBC of  $8.60 \times 10^9/L$ , blood amylase of 45.1 U/L, and urine amylase of 405.9 U/L.

### Surgical method

After a successful tracheal intubation using general anesthesia, the patient takes a right lying position to have his navel over the waist bridge so that the surgical table can be adjusted if necessary. An axillary pad is placed under the patient's axilla, a cotton pillow support is placed at the buttocks and the waist, and the patient is secured at the operating table with wide tapes. Three trocar puncture points are made on the waist. The location of the first puncture hole (main operation channel, 12 mm) is at the junction of the posterior axillary line, which is 2 cm away from the inferior border of the 12th rib. A cavity is made with a 1.5–2.0 cm transverse incision. A dilatation balloon is placed into the space between the lower part of the lumbodorsal fascia and the retroperitoneal fat using the fingertips, and the retroperitoneal cavity is established after a dilatation of 300–500 ml. Using the fingers as guides, the second trocar (5 mm) is inserted at the junction between the anterior axillary line and a spot 2 cm under the rib arch to be used as an auxiliary operation hole. The third puncture hole is generally selected at the junction between the middle axillary line and a spot 2–3 cm away from the superior border of the iliac crest. Again, using the fingers as guides, the third trocar (10 mm) is inserted to serve as a laparoscopic observation hole. The retroperitoneal space is separated with an ultrasound knife and then fully expanded. At the same time, an upper and posterior exploration is conducted. During the surgery, a B ultrasonic guidance and positioning is used to expand the retroperitoneal space for adequate drainage and to remove as much necrotic tissue as possible. The tissues cannot be removed by force and are therefore sucked out with an aspirator and then flushed with a copious amount of warm

saline water. Before completion of the surgery, a drainage tube is placed around the pancreas and into the retroperitoneal space for drainage.

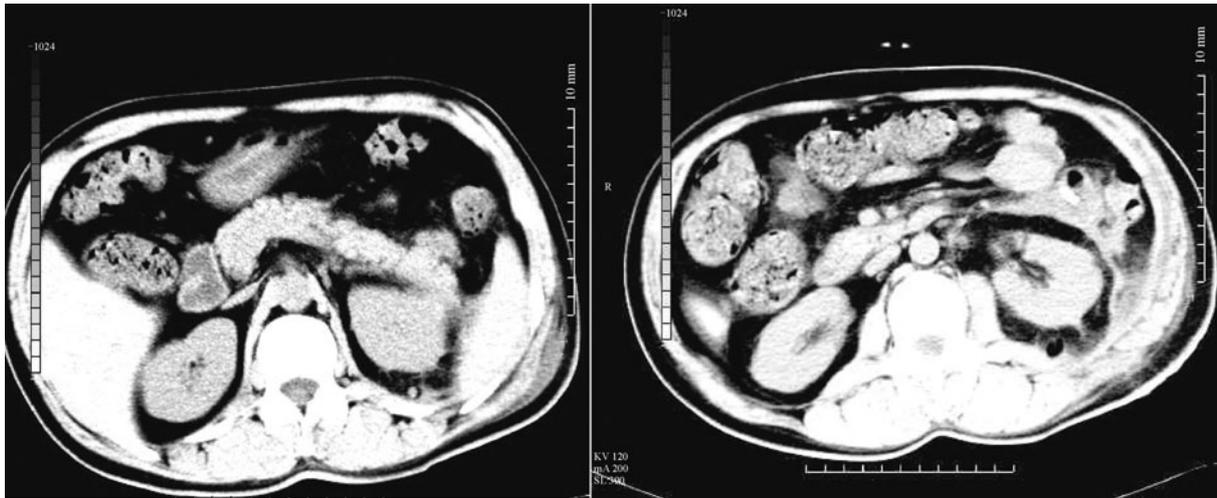
Of the 15 cases in the current study, 10 patients received the drainage purely via retroperitoneal laparoscopy, 4 patients received the drainage via retroperitoneal laparoscopy as well as through a preperitoneal approach, and 1 patient received laparotomy. The bilateral drainage via the retroperitoneal approach can be adopted for some patients; however, the right pathological changes are relatively mild in the studied cases, so bilateral drainage is not adopted.

### Results

Thirteen patients exhibited good drainage results and were successfully cured without any other surgical treatment. Nine patients received retroperitoneal laparoscopic drainage, three patients received drainage via retroperitoneal and preperitoneal laparoscopy, and one patient received laparotomy (Fig. 2). Two patients, one having received a purely retroperitoneal laparoscopic drainage, and the other having received both retroperitoneal and preperitoneal laparoscopic drainage, developed encapsulated effusions or pancreatic pseudocysts after the surgery. However, they were successfully cured after lavage and drainage using a B ultrasonic-guided puncture catheter.

### Discussion

According to the traditional view, the development of pancreatitis is mainly caused by the auto-digestion of the pancreatic tissue resulting from the abnormal activation of



**Fig. 2** Two days after hospitalization, the 44-year-old patient received a retroperitoneal laparoscopic drainage around the pancreas under general anesthesia. During the surgery, the anterior pararenal space around the pancreas was dissociated and a light bloody fluid of about 500 ml flowed out. The necrotic tissues around the pancreas were removed with an aspirator. Two drainage tubes were then arranged: one tube was placed at the tail of the pancreas, whereas the other was placed at the posterior pararenal space. The tubes were then led out from the puncture holes. After a month, the patient recovered based on CT examination.

pancreatic enzymes, which causes pancreatic necrosis. A large number of necrotic tissues and inflammatory substances are then generated in and around the pancreas. Finally, the inflammatory substances cause the systemic inflammatory response syndrome after entering into the blood circulation. Therefore, tissue necrosis is the primary cause of the pathologic and physiologic changes in pancreatitis. A number of hydrops in the abdominal cavity, which result from tissue necrosis, as well as various pancreatic digestive enzymes, infection, and necrotic tissues in and around the pancreas, play an important role in the course of evolution of SAP [2]. The traditional surgical method mainly focuses on the removal of necrotic tissues; however, research shows that resection of necrotic tissues can increase the risk of death. The treatment outcome of different surgical methods investigated by Takeda *et al.* [3] shows that in surgical drainage cases, the fatality rate of uninfected patients is 17.7% (45 cases), whereas that of infected patients is 28.1% (57 cases); in cases of necrotic tissue removal and lavage, the fatality rate of uninfected patients is 23.1% (13 cases), whereas that of infected patients is 35.7% (28 cases); and in cases of necrotic tissue resection and open drainage, the fatality rate of infected patients is 41.2% (17 cases).

However, according to the latest SAP microcirculatory disturbance theory, the microcirculatory disturbance of pancreatic tissues and the high pressure in multiple compartments are some of the primary causes of the rapid development of SAP, and that tissue necrosis is the result of the high pressure and microcirculatory disturbance, not the cause [4]. Therefore, the purpose of surgery should be to

reduce pressure, improve the microcirculation in pancreatic tissues, and control further aggravation. Surgical therapeutic principles should therefore be based on the reduction of pressure, drainage, and reduction of surgical injury and should not focus on the resection of necrotic pancreatic tissues [5].

The pancreas is a retroperitoneal organ. When the retroperitoneal region is stimulated and infected by an inflammation (like a duodenal perforation in the retroperitoneal region and SAP), inflammation, edema, and exudation will rapidly take place. High pressure, microcirculatory disturbance, and tissue necrosis easily take place in the retroperitoneal region because of its compartmentalized structure [6,7]. In recent years, a number of minimally invasive techniques, such as the B ultrasonic- or CT-guided percutaneous drainage and preperitoneal or retroperitoneal laparoscopic drainage, were invented. In particular, drainage via retroperitoneal laparoscopy clearly reduces the occurrence of the multiple organ dysfunction syndrome after surgery and improves the prognosis of SAP [8]. The following are several traditional methods used in peritoneal cavity drainage:

1. B ultrasonic- or CT-guided percutaneous catheter drainage, which is simple, practicable, and causes only minor injuries [9]. However, it easily injures surrounding tissues and organs, especially the hollow organs not clearly displayed under the B ultrasound, which makes the accurate positioning of the instrument difficult. The catheter is generally thin, so the drainage is easily blocked and cannot be adequately conducted. Although repeated punctures can be used, the chance of infection is also increased.

2. Catheter drainage via preperitoneal laparoscopy, which causes only minor injuries. However, creating a pneumoperitoneum and exposing the abdominal tissues are difficult, and the drainage is not effective. Moreover, early pancreatic exudation is mainly located in the retroperitoneum and has a greater effect on the function of the abdominal organs because the operation is conducted through the abdominal cavity.

Aside from effectively overcoming the above-mentioned disadvantages, catheter drainage via retroperitoneal laparoscopy has its unique advantages: (1) it is targeted more for the treatment of pancreatitis because of direct drainage from the retroperitoneal space; (2) it causes only minor injury. No huge incision on the abdominal wall is necessary, and the omental bursa and colonic ligament are not necessarily cut off; (3) it has little effect on the abdominal organs. Its operation is basically conducted in the retroperitoneum, and the abdominal cavity is not opened; and (4) the drainage is thorough. The drainage tube leads out mainly from the lateral posterior abdominal wall, and gravitational factors can be used in addition to power drainage such as siphoning and negative pressure.

Currently, most researchers think that the surgical indications for the treatment of SAP via the laparoscopic catheter drainage can be properly relaxed, and that the surgical opportunity can be set ahead and should not rigidly adhere to the occurrence of pancreatic infection [10,11]. We think that as long as an obvious exudation around the pancreas can be detected by imaging, drainage via retroperitoneal laparoscopy can be adopted. If the inflammatory exudation of the pancreatitis cannot be drained in time, the probability of a secondary infection is increased to 40%–70% [12]. For a patient who receives surgery during the acute reaction period, especially within one to two weeks after the incidence, a surgical operation is easier to accomplish, the surgical time is short, and the patient's postoperative recovery is quite smooth. With the extension of course, separating the adhesion, organization and fiber caused by purulent inflammation is extremely difficult; sometimes, achieving a satisfactory drainage is also hard. Of the cases in the current study, one patient was subjected to laparotomy because a long time has passed since the incidence of the disease, hyperemia was serious in the retroperitoneum and around the pancreas, and a laparoscopic operation would be difficult.

In summary, we believe that the main pathological cause of pancreatitis is regional high pressure and microcirculatory disturbance. Thus, the main purpose of early surgical treatment is pressure reduction and drainage to improve the microcirculation in the pancreas. Drainage via retroperitoneal laparoscopy is more suitable for the pathologic and physiologic process of pancreatitis and offers a more accurate and more thorough drainage; thus, it is the better technique for SAP drainage at present. Meanwhile, surgical opportunity should be properly planned. Surgery can be used as long as an obvious exudation around the pancreas is detected by imaging. Based on the hydrops situation in the abdominal

cavities of the patients in the current study, only retroperitoneal drainage should be used, or it can be combined with other surgical methods.

## Acknowledgements

This work was supported by the National Natural Science Foundation of China (No. 30972895) and the Natural Science Foundation of Chongqing of China (No. 2009BA5014).

## References

1. Besselink MG, de Bruijn MT, Rutten JP, Boermeester MA, Hofker HS, Gooszen HG, Dutch Acute Pancreatitis Study Group. Surgical intervention in patients with necrotizing pancreatitis. *Br J Surg* 2006; 93(5): 593–599
2. McKay CJ. Recent developments in the management of acute pancreatitis. *Dig Surg* 2002; 19(2): 129–134
3. Takeda K, Matsuno S, Sunamura M, Kobari M. Surgical aspects and management of acute necrotizing pancreatitis: recent results of a cooperative national survey in Japan. *Pancreas* 1998; 16(3): 316–322
4. Takeda K, Mikami Y, Fukuyama S, Egawa S, Sunamura M, Ishibashi T, Sato A, Masamune A, Matsuno S. Pancreatic ischemia associated with vasospasm in the early phase of human acute necrotizing pancreatitis. *Pancreas* 2005; 30(1): 40–49
5. Mentula P, Hienonen P, Kemppainen E, Puolakkainen P, Leppäniemi A. Surgical decompression for abdominal compartment syndrome in severe acute pancreatitis. *Arch Surg* 2010; 145(8): 764–769
6. Hunter JD, Damani Z. Intra-abdominal hypertension and the abdominal compartment syndrome. *Anaesthesia* 2004; 59(9): 899–907
7. De Waele JJ, Delrue L, Hoste EA, De Vos M, Duyck P, Colardyn FA. Extraprostatic inflammation on abdominal computed tomography as an early predictor of disease severity in acute pancreatitis: evaluation of a new scoring system. *Pancreas* 2007; 34(2): 185–190
8. van Santvoort HC, Besselink MG, Bollen TL, Buskens E, van Ramshorst B, Gooszen HG, Dutch Acute Pancreatitis Study Group. Case-matched comparison of the retroperitoneal approach with laparotomy for necrotizing pancreatitis. *World J Surg* 2007; 31(8): 1635–1642
9. Ai X, Qian X, Pan W, Xu J, Hu W, Terai T, Sato N, Watanabe S. Ultrasound-guided percutaneous drainage may decrease the mortality of severe acute pancreatitis. *J Gastroenterol* 2010; 45(1): 77–85
10. Szentkereszty Z, Sápy P. The role of percutaneous external drainage in the treatment of fluid collections associated with severe acute pancreatitis. What, when and how to drain? *Orv Hetil* 2007; 148(30): 1395–1399 (in Hungarian)
11. Heiss P, Bruennler T, Salzberger B, Lang S, Langgartner J, Feuerbach S, Schoelmerich J, Hamer OW. Severe acute pancreatitis requiring drainage therapy: findings on computed tomography as predictor of patient outcome. *Pancreatol* 2010; 10(6): 726–733
12. Rettally CA, Skarda S, Garza MA, Schenker S. The usefulness of laboratory tests in the early assessment of severity of acute pancreatitis. *Crit Rev Clin Lab Sci* 2003; 40(2): 117–149