

Laparoscopic Management of Severe Acute Pancreatitis

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Introduction: Severe acute pancreatitis (SAP) remains a serious disease state difficult to manage. Laparoscopic surgery represents a relatively new solution to this problem. This study was aimed to investigate the feasibility of laparoscopic treatment of SAP and the selection of laparoscopic procedures in various stages of SAP according to different pathologic alterations.

Methods: Thirteen patients, 9 men and 4 women with an average age of 46 years old, were diagnosed with SAP. Laparoscopic necrosectomy followed by external drainage were performed on 7 patients with massive fluid collections and/or infected necrosis in acute reaction phase of SAP. For 2 cases in subacute phase characterized by fresh-formed adhesions and encapsulation, laparoscopic intracavitary debridement experienced difficulty. For the other 4 patients in late phase with well-defined pancreatic or peripancreatic pseudocyst/abscess, ultrasound-guided, directly visualized laparoscopic intracavitary debridement, and external drainage were carried out with ease and efficiency.

Results: Laparoscopic procedures were accomplished successfully on 12 patients (92.3%), except for 1 conversion (7.7%) to open laparotomy owing to poor exposure and hard maneuvers in subacute phase. There was no mortality in this group. Patients were witnessed to have accelerated recovery following laparoscopic surgery.

Conclusion: Laparoscopic technique offers new hope for the treatment of SAP. It is recommended as a feasible, effective, and less traumatic therapeutic means on condition that the strategy of individualization is followed.

Key Words: severe acute pancreatitis, laparoscopic surgery, pancreatic necrosectomy, intracavitary debridement, external drainage, management

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Severe acute pancreatitis (SAP), a serious clinical entity that is often complicated by a complex pathologic process, has remained difficult to manage.¹ Patients with SAP are at great risk for infection, multiple system organ failure, and even

death. How to reduce the high morbidity and mortality rate of SAP and improve its prognosis remains a formidable challenge existing in the new century.^{2,3} Currently, treatment in SAP is mainly supportive.¹ Surgical intervention is required when severe infected pancreatic necrosis takes place in early course or symptomatic non-resolving pseudocyst presents in later stage.⁴ However, the outcome of operative treatment of SAP is no way encouraging with surgical stress ensuing a lot of events to complicate the management.^{5,6}

Over the last decade, laparoscopic technique has evolved markedly. It has been demonstrated as an effective and less traumatic way in the management of many surgical problems.⁷ Hence we hypothesized that, with all its advantages, laparoscopic surgery could be an efficient alternative to minimize the surgical trauma and to accelerate the recovery process in the management of SAP in operative intervention indicated patients. It is an attractive issue in this field. There are several reports, with amazing results, available on laparoscopic treatment of SAP.^{8–11} This article describes our laparoscopic experience on 13 patients with various pathologic alterations of this disease. It is aimed to verify the feasibility of laparoscopic management of SAP and to obtain a rudimentary knowledge on the selection of laparoscopic procedures in different stages of SAP.

METHODS

Patients

Thirteen consecutive patients with SAP in different stages underwent laparoscopic treatment at the West China Hospital between March 1999 and March 2001. Data were collected retrospectively from hospital charts. There were 9 men and 4 women in this series with an average age of 46 years old (range, 27–54 years). All patients were diagnosed by the APACHE II (acute physiology score and chronic health evaluation) scoring system with a score higher than 8 defined as SAP.¹²

Patients underwent standard preoperative workup, including conventional blood tests, chest radiograph, electrocardiogram, ultrasonography, and CT scan. Fine needle aspiration was used in selected patients to verify the presence of infected necrosis. Preoperative findings suggested that 7 patients suffered massive effusions in the peritoneal cavity and/or in the

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lesser sac. Amylase level in plasma, urine, and abdominal paracentetic fluid was detected increasing significantly after admission. Ultrasonic and/or CT scan demonstrated tumefaction of the pancreas. Four of the patients were found to have focal parenchymal necrosis to variant extent, which was accompanied by infection, high temperature, elevation of white cell counts, and abdominal distention. Conservative therapy didn't witness any favorable results before laparoscopic surgery was performed. Another 6 patients developed peripancreatic pseudocysts or abscesses with the progress of the disease. Of those, 2 patients had maintained stable conditions for 2 weeks after the acute attack of SAP. However, the giant cysts (diameter, 27–32 cm) lying retroperitoneally didn't decrease by palliative therapy but worsened the symptom of stomach compression. The other 4 cases had been in relatively steady condition for 7 to 11 weeks since the first episode only to develop peripancreatic cysts (diameter, 13–16 cm) in the later phase, which didn't show any tendency of absorption or contraction. Of the 13 patients 1 case presented with obstructive jaundice owing to the secondary choledocholith, 3 had calculi or cholesterol polyps in the gallbladder, and 1 had chronic hepatitis without hepatic function compensation, 2 patients were associated with pulmonary insufficiency and/or renal failure.

Operative Techniques

All laparoscopic procedures were performed by three surgeons (ZG Zhou, Y Shu, WM Hu). For patients in acute reaction phase of SAP with focal infected pancreatic necrosis and/or massive fluid collections in the abdominal cavity, an anterior approach was adopted to access the peritoneal cavity. The patients were put in the supine position under general anesthesia with intratracheal intubation. The surgeon was positioned right of the patient, with the second assistant on the same side and the first assistant on the patient's left. Two video monitors were usually needed, which were positioned at each of the patient's shoulders. Generally, 4 trocars were used. After establishing the carbon dioxide pneumoperitoneum, a 30° angled laparoscope was introduced via the supraumbilical port and an exploratory laparoscopy was performed. Two paramedian trocars and a subxiphoid trocar were inserted under direct vision. Initially, the stomach was retracted upward and the transverse colon mobilized downward to tense the gastrocolic ligament, in which a wide opening was made to expose the lesser sac. The massive fluid collections staying in the sac was drained then the pancreas capsule was opened longitudinally and a thorough exploration was made to find out the necrotic tissues. To disclose the localized necrosis lying in retroperitoneum, the pancreas need to be lift up gently. Next, all the obvious necrotic tissues were cleaned with a combination use of suction, clipping, and cutting. These procedures should be performed carefully in an aim to reduce possible bleeding. Good results could be expected using hemostatic gauze or gelatin

sponge soaked with thrombin if massive effusions of blood occurs. When necrosectomy was completed, multiple big-caliber catheters (diameter, 10–20 mm) were placed in the lesser sac and peritoneal cavity, which were pulled up to the anterior abdominal wall through the punctures. If severe retroperitoneal involvement is present, the debris should be drained through the lateral abdominal wall or via the lumbar region.

For patients in subacute phase or in the later course of SAP with peripancreatic pseudocysts or abscesses we once tried to reach the lesser sac through the anterior abdominal approach, but encountered more bleeding, prolonged operative time, and increased possibility of injuring adjacent structures. Therefore, ultrasound-guided puncturing through the lateral abdominal or posterior lumbar region was adopted. The cavity was entered directly with 12-mm trocar or 18-mm trocar, then it was insufflated with appropriate carbon dioxide to achieve a satisfying visualization. Laparoscope and related instruments were advanced through trocars into the cavity. With the aid of the laparoscope, the jet lavage irrigator/suction device was used to evacuate the thick fluid or debris. A grasper was applied to clean larger necrotic tissues. With careful manipulation and by using the jet lavage suction-irrigating system, any cavity was washed until it was nearly devoid of any remains. At the end of the procedures several large-bore catheters replaced the trocars to guarantee proper drainage and irrigation of the abdominal cavity postoperatively.

Perioperative Treatments

The combination treatments of traditional Chinese medicine and Western medicine were made in all patients pre- and postoperatively, which included fasting, fluid resuscitation, inhibition of pancreatic secretion, antibiotic therapy, and oral administration of the traditional Chinese medicine "yi huo qing xia".¹³ Total parenteral nutrition therapy was made in selected patients. Continuous drainage and irrigation of the peritoneal cavity, the lesser sac, the cyst or abscess cavity was conducted every day with 5000 to 10000 mL normal saline and 500 to 1000 mL metronidazole solutions following the operation. Necrotic tissues were evacuated in time with laparoscopic reexploration performed on necessary cases.

RESULTS

Twelve (92.3%) of the 13 patients were treated with laparoscopy successfully except for 1 patient (7.7%) in subacute phase converted to open procedure because of poor exposure (Table 1). Three patients concomitant with calculi or cholesterol polyps in the gallbladder received laparoscopic cholecystectomy at the same time. Laparoscopic common bile duct exploration and T-tube drainage were also performed simultaneously on 1 patient with obstructive jaundice. There was no mortality and no major postoperative morbidity. A regular follow-up of 6 months or more was made on all patients. Twelve (92.3%) patients achieved complete resolution following 2 to 7

TABLE 1. Laparoscopic Treatment of SAP According to Various Pathological Alterations

| Staging | Patients | Complications | Surgical Approaches | Procedures Done | Conversion | Success |
|----------------|----------|---|---|--|------------|---------|
| Early stage | 7 | Fluid collections or infected necrosis | Anterior abdominal approach | Laparoscopic necrosectomy & external drainage | 0 | 7 |
| Subacute phase | 2 | Adhesions and freshly formed pseudocyst | Anterior or lateral abdominal approach | Laparoscopic intracavitary debridement & external drainage | 1 | 1 |
| Later stage | 4 | Well formed pseudocyst or abscess | Anterior or lateral abdominal approach or posterior lumbar approach | Laparoscopic intracavitary debridement & external drainage | 0 | 4 |

weeks drainage after operation, which was confirmed by ultrasonography. One patient (7.7%) developed pancreatic pseudocyst after removal of drainage catheters and a laparoscopic cystoenterostomy was needed 6 months later to ensure a promising recovery.

DISCUSSION

Feasibility of Laparoscopic Treatment of SAP

The success of first laparoscopic cholecystectomy in 1987 has led to a revolution in surgical fields.¹⁴ Minimally invasive techniques represented by laparoscopic procedure has been regarded as a new preferable option for patients in the 21st century.^{7,15} At this time, management of SAP is predominantly supportive.¹ Acute fluid collections occurred early in the course of SAP and most pancreatic or peripancreatic pseudocysts appearing in the later stage can be managed by active nonoperative therapy.¹⁶ Operative treatment is indicated for patients in whom infected necrotizing pancreatitis develops or symptomatic non-resolving pseudocyst presents.^{4,16} One of the chief concerns is that surgical stress and interventional maneuvers in the abdominal cavity might breakdown the local on-building defensive barrier, thus aggravating the conditions in the already compromised patients.¹⁷ In this regard, we dwell on the following issues: whether we could employ the laparoscopic technique to perform pancreatic necrosectomy so as to lessen the stress of surgery and to improve the outcome of surgical intervention and could we use the laparoscopic procedures actively to drain the peritoneal cavity and the lesser sac during supportive therapy, thus to reduce the occurrence of infection and to speed up the progress of recovery.

Laparoscopic treatment of pancreatitis was initially described by Gagner.⁸ In his report, a group of 8 patients with necrotizing pancreatitis were treated with laparoscopic surgery. The technique resulted in 75% success after the first drainage of this disease. There was no mortality, and reoperation was only necessary in 25% of patients. Treatment of

acute necrotizing pancreatitis via laparoscopic necrosectomy, drainage, and irrigation of the lesser sac was also reported by Cuschieri et al.⁹ In this study 12 patients underwent laparoscopic surgery and recovered evenly, except 1 conversion to open procedure because of the presence of extensive adhesions in peritoneal cavity. This result was better than that of conventional surgical treatment (performed by the same group during the same period), which has a higher morbidity (32/55, 58%) and mortality (6/55, 11%) rate (data not published). Our knowledge in this series showed that it was safe and possible to launch laparoscopic procedures in SAP on condition that dexterity of this technique was obtained and strategy of individualization was observed. The efficacy of laparoscopic technique was closely related to the extent of pancreatic necrosis as well as the appropriate selection of surgical procedures according to the pathologic alterations in different stages of SAP.⁶

Selection of Laparoscopic Procedures in Various Stages of SAP

In the acute reaction phase of SAP, 30% to 50% of patients may have massive fluid collections in the peripancreatic space or in the peritoneal cavity.¹⁸ The volumes vary from hundreds of to thousands of milliliters, which can be drained by laparoscopic external drainage. For this purpose the gastrosplenic ligament needs to be divided. Then laparoscopic necrosectomy can be completed under direct vision with the lesser sac opened. The use of laparoscopy in this stage resulted in less bleeding, shorter operative time and less surgical trauma. The stress of surgery was minimized to avoid many complications following the conventional operative procedures.^{15,19} Owing to these advantages the indications for laparoscopic surgery may be less strict than for open intervention during this period. Zhu et al,¹¹ performed laparoscopic irrigation, drainage, and decompression of pancreas on 10 patients within 24 to 72 hours after the onset of acute pancreatitis. Only 1 death occurred because of adult respiratory distress syndrome (ARDS) soon after the operation. The success rate was 90%. In our

study, All 7 patients that underwent laparoscopic treatment in early stage recovered smoothly. It is our impression that laparoscopic surgery plays an important role in the management of SAP in early stage of this disease.^{5,11,20} A timely drainage of fluid and a thorough debridement of necrotic tissues can be achieved with laparoscopy use, which helps to shorten the natural course of SAP and reduce the occurrence of pancreatic cyst and abscess.

In the subacute reaction phase of SAP, residual fluid is gradually absorbed and adhesions in the peritoneal cavity begin to appear but still not well developed. An improper launch of laparoscopic procedure despite the extensive adhesions and the disorder of anatomic relationship in the abdominal cavity may result in massive bleeding, prolonged operative time, and increased possibility of injuring adjacent structures, especially air containing organs. In addition, surgical intervention at that moment may destroy the local guarding barrier and intervene into the systematic defensive function as well.¹⁷ Therefore, indications for surgery in this phase should be strictly controlled and the integrated treatments of traditional Chinese medicine and Western medicine are recommended to facilitate the localization of infection, absorption of hydrops, and formation of encapsulation.²¹ For conditions where surgical treatment can't be avoided, operative laparotomy may be a preferred choice to prevent injury of neighboring organs. In this series of study one patient (7.7%) receiving laparoscopic treatment was obliged to convert to open procedure because of poor exposure and hard maneuvers, which acted as a case in point.

In the later course of SAP, surgical treatment must be taken into consideration when systematic non-resolving pancreatic or peripancreatic cyst, or abscess is present.^{3,22} The modes of surgery are related to the following concerns²³: whether the pancreatic duct has an access to the pseudocyst and is there any pancreatic juice in the cavity, whether the focal part of the pancreas that has communication with the cyst cavity can be drained via the pancreatic duct system, and whether there is any obstruction existing in the proximal pancreatic duct, including constriction, blockage, or breakage of the duct. These can be made clear by cystography,²⁴ endoscopic retrograde cholangiopancreatography,²⁵ or by the aspiration cystic fluid analysis under the direction of ultrasound.²⁶ Internal drainage is a preferable therapeutic option when any definite and persistent obstruction is detected, such as the focal constriction or occlusion of the proximal pancreatic duct. There have emerged several reports on endoscopic internal drainage,²⁷ laparoscopic cystoenterostomy,^{28–30} and laparoscopic cystogastrostomy,^{31–34} for the management of pancreatic pseudocyst. Recently, Alverdy et al.³⁵ reported their experience of laparoscopic intracavitary debridement of pancreatic necrosis on 2 patients with well-defined abscesses. Our study also supports that laparoscopic intracavitary debridement with the guidance of ultrasound is a good alternative for patients, in whom pseudocyst cavity received no or little pancreatic fluid

and no evidence of obstruction of the proximal duct. Good results could be achieved if continuous drainage of the cyst or abscess cavity via multiple large-bore drainage tubes is guaranteed following the laparoscopic procedures.³⁵

Generally speaking, the appropriate surgical treatment of SAP remains controversial. Laparoscopic technique offers a new surgical alternative to this problem. The majority of operative procedures can be completed laparoscopically in a skillful hand. Based on our preliminary experience, patients seem to benefit from laparoscopic treatment. It is recommended as a feasible, effective, and less traumatic therapeutic option for the management of SAP. However, strategy of individualization should be closely observed in the selection of laparoscopic procedures in various stages of SAP to optimize the outcome of surgical treatment. Future well-defined large-sampled randomized controlled studies are needed to define the role of laparoscopy in the management of SAP.

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REFERENCES

- McKay CJ. Recent Developments in the Management of Acute Pancreatitis. *Dig Surg*. 2002;19:129–134.
- Ashley SW, Perez A, Pierce EA, et al. Necrotizing pancreatitis: contemporary analysis of 99 consecutive cases. *Ann Surg*. 2001;234:572–579.
- Gullo L, Migliori M, Olah A, et al. Acute pancreatitis in five European countries: etiology and mortality. *Pancreas*. 2002;24:223–227.
- Chaudhary A, Dhar P, Sachdev A, et al. Surgical management of pancreatic necrosis presenting with locoregional complications. *Br J Surg*. 1997;84:965–968.
- Hartwig W, Maksan SM, Foitzik T, et al. Reduction in mortality with delayed surgical therapy of severe pancreatitis. *J Gastrointest Surg*. 2002;6:481–487.
- Gotzinger P, Sautner T, Kriwanek S, et al. Surgical treatment for severe acute pancreatitis: extent and surgical control of necrosis determine outcome. *World J Surg*. 2002;26:474–478.
- Perissat J, Collet D, Monguillon N. Advances in laparoscopic surgery. *Digestion*. 1998;59:606–618.
- Gagner M. Laparoscopic Treatment of Acute Necrotizing Pancreatitis. *Semin Laparosc Surg*. 1996;3:21–28.
- Cuschieri SA, Jakimowicz JJ, Stultiens G. Laparoscopic infracolic approach for complications of acute pancreatitis. *Semin Laparosc Surg*. 1998;5:189–194.
- Hamad GG, Broderick TJ. Laparoscopic pancreatic necrosectomy. *J Laparoendosc Adv Surg Tech A*. 2000;10:115–118.
- Zhu JF, Fan XH, Zhang XH. Laparoscopic treatment of severe acute pancreatitis. *Surg Endosc*. 2001;15:146–148.
- Bradley EL 3rd. A clinically based classification system for acute pancreatitis: summary of the International Symposium on Acute Pancreatitis, Atlanta, GA, September 11 through 13, 1992. *Arch Surg*. 1993;128:586–590.
- Jiang JM, Zhang RM, Huang ZW, et al. Management of severe acute pancreatitis with Yi Huo Qing Xia, a combined therapy of traditional Chinese and western medicine: a report of 32 cases. *Zhongguo Zhong Xi Yi Jie He Wai Ke Za Zhi*. 1994;1:9–12.
- Mouret P. Celioscopic surgery: evolution or revolution? *Chirurgie*. 1990;116:829–832.

15. Fuchs KH. Minimally invasive surgery. *Endoscopy*. 2002;34:154–159.
16. Dubagunta S, Still CD, Komar MJ. Acute pancreatitis. *J Am Osteopath Assoc*. 2001;101:S6–S9.
17. Esposito S. Immune system and surgical site infection. *J Chemother*. 2001;13:12–16.
18. Isenmann R, Beger HG. Natural history of acute pancreatitis and the role of infection. *Baillieres Best Pract Res Clin Gastroenterol*. 1999;13:291–301.
19. Grande M, Tucci GF, Adorisio O, et al. Systemic acute-phase response after laparoscopic and open cholecystectomy. *Surg Endosc*. 2002;16:313–316.
20. Pamoukian VN, Gagner M. Laparoscopic necrosectomy for acute necrotizing pancreatitis. *J Hepatobiliary Pancreat Surg*. 2001;8:221–223.
21. Li ZL, Wu CT, Lu LR, et al. Traditional Chinese medicine Qing Yi Tang alleviates oxygen free radical injury in acute necrotizing pancreatitis. *World J Gastroenterol*. 1998;4:357–359.
22. Chowbey PK, Soni V, Sharma A, et al. Laparoscopic intragastric stapled cystogastrostomy for pancreatic pseudocyst. *J Laparoendosc Adv Surg Tech A*. 2001;11:201–205.
23. Tsiotos GG, Sarr MG. Management of fluid collections and necrosis in acute pancreatitis. *Curr Gastroenterol Rep*. 1999;1:139–144.
24. Patel BK, Garvin PJ, Aridge DL, et al. Fluid collections developing after pancreatic transplantation: radiologic evaluation and intervention. *Radiology*. 1991;181:215–220.
25. Reed DN Jr, Vitale GC. Interventional endoscopic retrograde cholangiopancreatography and endoscopic surgery. *Surg Clin North Am*. 2000;80:1171–1201.
26. Polakow J, Ladny JR, Serwatka W, et al. Percutaneous fine-needle pancreatic pseudocyst puncture guided by three-dimensional sonography. *Hepatogastroenterology*. 2001;48:1308–1311.
27. Sharma SS, Bhargawa N, Govil A. Endoscopic management of pancreatic pseudocyst: a long-term follow-up. *Endoscopy*. 2002;34:203–207.
28. Cuschieri A. Laparoscopic surgery of the pancreas. *J R Coll Surg Edinb*. 1994;39:178–184.
29. Hagopian EJ, Teixeira JA, Smith M, et al. Pancreatic pseudocyst treated by laparoscopic Roux-en-Y cystojejunostomy. Report of a case and review of the literature. *Surg Endosc*. 2000;14:967.
30. Champault G, Rizk N, Lebhar E, et al. Laparoscopic treatment of pancreatic pseudocyst. 3 cases. *Ann Chir*. 1998;52:41–44.
31. Holeczy P, Danis J. Laparoscopic transgastric pancreatic pseudocystogastrostomy—first experience with extraluminal approach. *Hepatogastroenterology*. 1998;45:2215–2218.
32. Smadja C, Badawy A, Vons C, et al. Laparoscopic cystogastrostomy for pancreatic pseudocyst is safe and effective. *J Laparoendosc Adv Surg Tech A*. 1999;9:401–403.
33. Shimizu S, Morisaki T, Noshiro H, et al. Laparoscopic cystogastrostomy for pancreatic pseudocyst: a case report. *JSLS*. 2000;4:309–312.
34. Chowbey PK, Soni V, Sharma A, et al. Laparoscopic intragastric stapled cystogastrostomy for pancreatic pseudocyst. *J Laparoendosc Adv Surg Tech A*. 2001;11:201–205.
35. Alverdy J, Vargish T, Desai T, et al. Laparoscopic intracavitary debridement of peripancreatic necrosis: preliminary report and description of the technique. *Surgery*. 2000;127:112–114.