

REVIEW ARTICLE

Laparoscopic Longitudinal Pancreaticojejunostomy for Chronic Pancreatitis

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ABSTRACT

Chronic pancreatitis is characterized by severe abdominal pain and progressive insufficiency of pancreatic endocrine/exocrine function. Pancreatic ductal drainage is one of the most important factors for the management of chronic pancreatitis. A longitudinal pancreaticojejunostomy is a simple and radical surgical treatment for pancreatic ductal drainage. However, in recent years laparoscopic pancreatic procedures have developed rapidly, and reports concerning laparoscopic pancreatic resection including laparoscopic longitudinal pancreaticojejunostomy have increased in number. Nevertheless, the benefits of laparoscopic longitudinal pancreaticojejunostomy for chronic pancreatitis compared with conventional open surgery are unclear. In this review, we note that laparoscopic longitudinal pancreaticojejunostomy is a technically feasible, safe and effective surgical procedure in selected patients with chronic pancreatitis.

INTRODUCTION

In patients with chronic pancreatitis, severe recurrent abdominal pain and functional endocrine/exocrine insufficiency of the pancreas are common and frequently debilitating [1–7]. The elevated pressure in the pancreatic ducts due to the obstruction of the pancreatic ducts is one of the main causes of the severe abdominal pain [8–10]. The combination of the ductal decompression and continuous drainage using a surgical procedure or an endoscopic approach comprise the basis for the treatment of patients with chronic pancreatitis [11–14]. With the recent development of various endoscopic instruments and techniques, endoscopic treatment can now be used as a first-line medical option for chronic pancreatitis [15–19]. However, the authors of two studies that compared endoscopic and surgical treatments of chronic pancreatitis patients reported that surgical treatment was more effective than endoscopic treatment [20, 21]. In a prospective randomized trial, Dite *et al.* [20] observed that surgical treatment was superior to endoscopic treatment for long-term pain reduction in patients with painful obstructive chronic pancreatitis. Cahen *et al.* [21] also reported that the benefits of a surgical drainage procedure were demonstrated by more rapid, effective, and sustained pain relief compared to endoscopic treatment. In addition,

Laramée *et al.* [22] found that surgical drainage treatment was highly cost-effective compared to endoscopic drainage treatment for patients with obstructive chronic pancreatitis.

Laparoscopic surgery was proposed as a minimally invasive alternative surgical procedure in the field of the pancreatic surgery [23–27]. Longitudinal pancreaticojejunostomy is a common and suitable surgical procedure to treat chronic pancreatitis patients with an obstructed and dilated main pancreatic duct [28–32]. Many studies of limited series of laparoscopic longitudinal pancreaticojejunostomy for the management of chronic pancreatitis have been reported [33–43], but the evaluations of the laparoscopic longitudinal pancreaticojejunostomy procedure have been limited and controversial. In this review, we discuss the current status of laparoscopic longitudinal pancreaticojejunostomy for chronic pancreatitis.

OPERATIVE TECHNIQUE

Laparoscopic trocars position of laparoscopic longitudinal pancreaticojejunostomy is about the same with laparoscopic distal pancreatectomy. We used five trocars (**Figure 1**). Severe adhesion between the posterior wall of the stomach and the anterior surface of the pancreas is often observed in patients with chronic pancreatitis. Such adhesion has been released with the use of several laparoscopic devices including laparoscopic coagulating shears (SonoSurg; Olympus, Tokyo), a vessel-sealing instrument (LigaSure; Covidien, Norwalk, CT), and an ultrasonically activated scalpel (Harmonic ACE; Ethicon, Cincinnati, OH). In these procedures, it is important to obtain a sufficient working space and ensure an adequate laparoscopic view. To maintain the exposure of the pancreas, the stomach is taped using sutures in two

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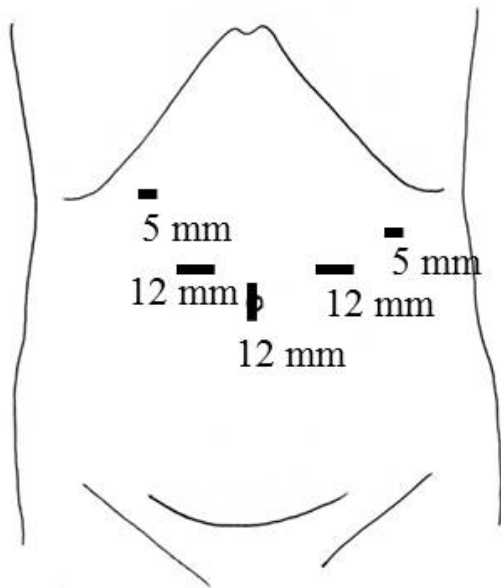


Figure 1. Placement of the five trocars.

places, and then the stomach is fixed to the abdominal wall. We called this method of retraction of the stomach the “stomach-hanging method” (**Figure 2**) [44]. It is often difficult to secure an adequate laparoscopic surgical field at the pancreatic tail. In this case, we used an endoscopic surgical spacer (Securea; Hogy Medical Co., Tokyo) to make the surgical space with appropriate isolation of the stomach and mesocolon without grasping organs [45].

In the longitudinal pancreaticoduodenectomy procedure for chronic pancreatitis, the main pancreatic duct is opened wide for complete drainage of the main pancreatic duct. To identify the main pancreatic duct, a thin needle such as a lumbar puncture needle is useful [36, 37]. The main pancreatic duct is confirmed by aspirating pancreatic juice. Laparoscopic ultrasound also helps to identify the dilated main pancreatic duct [43]. In addition, ultrasound is a useful tool for detection of the pancreatic stones in the pancreatic duct. We used a flexible laparoscopic ultrasound probe (Hitachi Aloka, Ltd., Tokyo) (**Figures 3a, b**). Pancreatic stones cause the obstruction of the main pancreatic duct and then cause the elevation of the pressure in the main pancreatic duct. The removal of the pancreatic stones is necessary to release the elevated pressure in the main pancreatic duct.

Usually, the pancreatic stones are removed under direct vision using laparoscopic grasping forceps. Sahoo *et al.* [43] reported that an endoscopic retrograde cholangiopancreatography basket viewed under a cystoscope was useful to remove leftover pancreatic stones in both the pancreatic head and tail end during a laparoscopic longitudinal pancreaticojejunostomy. However, the identification of the main pancreatic duct under laparoscopic guidance is unexpectedly difficult. In fact, Tania *et al.* [36] reported that four patients required conversion to open surgery, and in three of these procedures the main pancreatic duct could not be isolated laparoscopically.

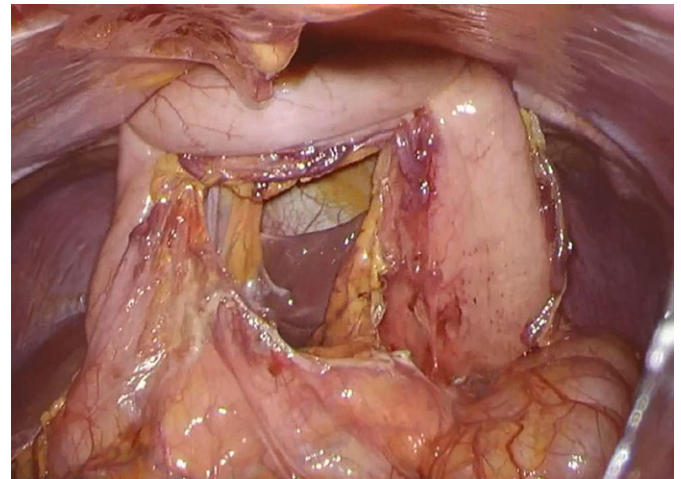


Figure 2. To maintain the exposure of the pancreas, the stomach is taped using sutures in two places, and then the stomach is fixed to the abdominal wall.

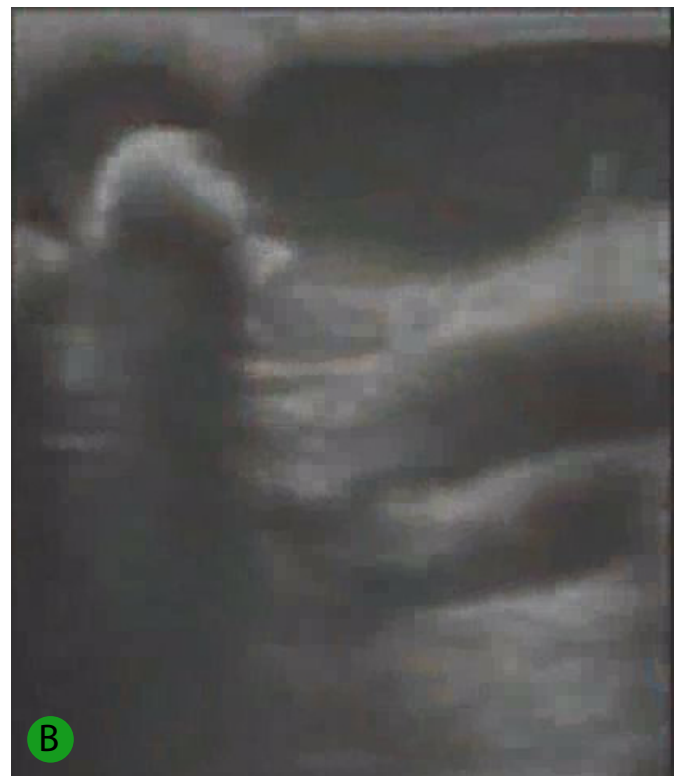
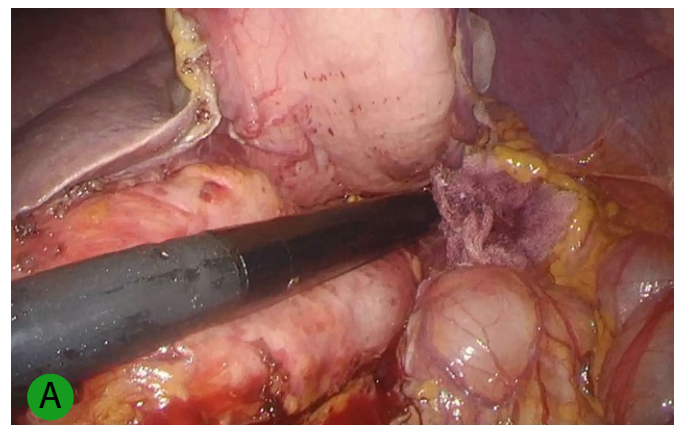


Figure 3. (a). Laparoscopic ultrasound is useful to identify the dilated main pancreatic duct, ductal strictures, pancreatic calcification, and pancreatic stones. **(b).** Intraoperative laparoscopic ultrasound showing a dilated main pancreatic duct and a pancreatic stone.

Khaled *et al.* [42] reported that the diameter of the main pancreatic duct in five patients who had undergone a complete laparoscopic longitudinal pancreaticoduodenectomy was 6–11 mm. They also noted that the use of laparoscopic ultrasound facilitated the identification of the pancreatic duct. Palanivelu *et al.* [37] reported that a good candidate diameter of the main pancreatic duct for a laparoscopic longitudinal pancreaticoduodenectomy was approx. 10 mm or larger. Sahoo *et al.* [43] reported that all 12 of their patients showed a diameter of more than 14 mm.

In most cases, a Roux loop of jejunum is fashioned and is brought to the lesser sac via the retrocolic route. A side-to-side longitudinal pancreaticojejunostomy is reconstructed laparoscopically using a single layer of continuous or interrupted sutures. The pancreaticojejunostomy should cover nearly the entire length of the dilated main pancreatic duct; otherwise, the insufficient length of the pancreaticojejunostomy presents the risk of obstructing the pancreaticojejunostomy, and this result causes the recurrence of the severe pancreatic pain post-surgery. We opened widely the main pancreatic duct using SonoSurg (Olympus) (Figure 4).

In general, it is difficult to suture laparoscopically in a pancreaticojejunal anastomosis for chronic pancreatitis, because chronic pancreatitis is accompanied by hard pancreatic parenchyma due to severe inflammation and pancreatic fibrosis. Santoro *et al.* [34] reported a laparoscopy-assisted longitudinal pancreaticojejunostomy with the mini-laparotomic left subcostal procedure for chronic pancreatitis patients with severe fibrotic pancreatic parenchyma. The hand-assisted laparoscopic surgery (HALS) strategy is also useful for pancreaticojejunal anastomoses for hard pancreatic parenchyma. The handling of a needle during pancreaticojejunal anastomoses for chronic pancreatitis is technically difficult because of the hard pancreatic parenchyma. However, it is well known that the postoperative risk of a pancreatic fistula of a hard pancreas such as that observed in chronic pancreatitis is low [46–48].

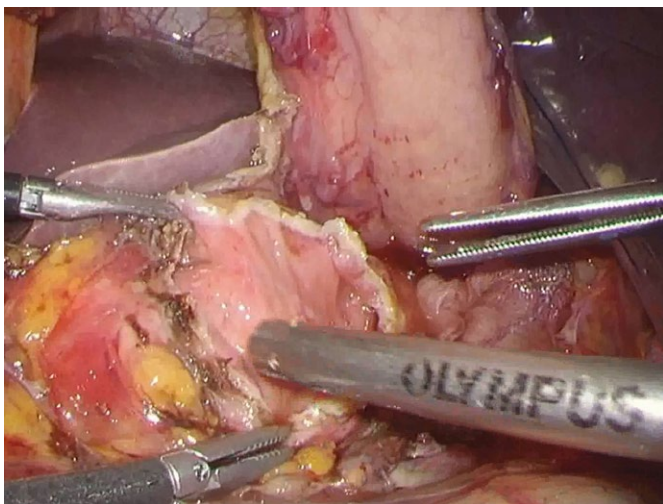


Figure 4. The main pancreatic duct is opened longitudinally.

Pancreatic fistula is one of the most common and serious complications after pancreatic surgery [49–51]. We suspected that a laparoscopic longitudinal pancreaticojejunostomy for chronic pancreatitis would require a long operative time, but this procedure is safer for chronic pancreatitis. Glaser *et al.* [35] reported the use of a laparoscopic linear stapler device in laparoscopic longitudinal pancreaticojejunostomy. Anastomosis using a laparoscopic linear stapler is a familiar procedure for the drainage of the pancreatic pseudocyst. This technique is simple, easy and useful when the main pancreatic duct is extremely dilated and there are no residual pancreatic stones or stenosis of the main pancreatic duct.

OPERATIVE OUTCOMES

The main published series of laparoscopic longitudinal pancreaticojejunostomy for chronic pancreatitis are listed in Table 1. A total of 60 patients in the 11 available reports are featured in this review. Conversion to open surgery was required in five patients (8%). The reason for conversion was an inability to detect the main pancreatic duct under laparoscopic guidance in three of the patients and bleeding from branches of the splenic vein in the other two patients. The operating times ranged from 103 to 390 min. The case with the longest operative time was performed by robotic surgery. There were no operative mortalities. Postoperative complications were observed in five of the 60 patients (8%).

One of the most common and serious complications after pancreatic surgery is pancreatic fistula. In this series, only one patient (2%) showed postoperative pancreatic fistula. Several studies have shown that nonfibrotic pancreas, so-called 'soft pancreas,' is one of the most important risk factors for postoperative pancreatic fistula after pancreatic surgery [46–48]. Chronic pancreatitis is characterized by severe pancreatic fibrosis with the destruction of endocrine and exocrine pancreatic function [1–7]. Both pancreatic fibrosis and low pancreatic function are favorable to prevent a pancreatic fistula in chronic pancreatitis. Nealon *et al.* [12] reported that the complication rate, including pancreatic fistula, in conventional pancreaticojejunostomy for chronic pancreatitis was 4% for 124 patients.

The length of hospital stay can provide a valid measure of the invasiveness of an operative procedure. In this series of 60 patients, the range of length of hospital stay was from 3 days to 10 days. These length of hospital stay data are probably affected by a bias, because the studies were retrospective and the sample sizes were too small. Another parameter of invasiveness is intraoperative blood loss. Laparoscopic approaches using a magnified view have a potential advantage in that there is improved visualization of the anatomy for the resection of adhesive tissues and vessels along appropriate planes during a laparoscopic longitudinal pancreaticojejunostomy for chronic pancreatitis. However, there has been no randomized controlled study on laparoscopic versus conventional open longitudinal pancreaticojejunostomy for chronic

Table 1. Main published series of laparoscopic longitudinal pancreaticojejunostomy for chronic pancreatitis.

Authors	Published Year	No. of Patients	Conversion to Open Surgery	Operating Time (min)	Blood Loss (mL)	Mortality (%)	Morbidity (%)	Hospital Stay (days)	Follow-up
Kurian <i>et al.</i> [33]	1999	5	1, bleeding	240 ^a	NA ^b	0	20 1, pancreatic fistula	3 - 7	5 to 30 months; 3 patients obtained pain relief, one patient died of coronary insufficiency, one patient had recurrence of pain which necessitated a thorascopic splanchnicectomy
Santoro <i>et al.</i> [34]	1999	1	0	140	NA	0	0	7	NA
Glaser <i>et al.</i> [35]	2000	1	0	115	NA	0	0	NA	8 months; no dilatation of the pancreatic duct and no recurrent pancreatitis
Tantia <i>et al.</i> [36]	2004	17	4 3, inability to isolate the main pancreatic duct; 1, bleeding	277 ^a 377 ^a , three patients were performed additional procedures	NA	0	11.8 1, wound infection; 1, internal herniation	4 - 7	3 to 12 months, 14 patients obtained pain relief, 16 patients showed no weight loss, one patient increased pain
Palanivelu <i>et al.</i> [37]	2006	12	0	178.5 (113-225) ^a	NA	0	8 1, wound infection	4 - 7	6 to 84 months, 10 patients obtained pain relief, all patients showed significant weight gain
Khaled <i>et al.</i> [38]	2011	1	0	360	200	0	0	5	7 months, pain relief and showed resolution of the pancreatic ductal dilatation
Palanivelu <i>et al.</i> [39]	2011	1 ^c	0	220	NA	0	0	5	3 months, pain relief and all pancreatic enzyme supplements were withdrawn
Meehan <i>et al.</i> [40]	2011	1 ^d	0	390	NA	0	0	8	24 months, pain relief
Zhang <i>et al.</i> [41]	2012	4 ^e	0	121 (103 - 154) ^a	minimal	0	0	4 - 6	3 to 25 months; all patients obtained pain relief, all patients showed significant weight gain
Khaled <i>et al.</i> [42]	2014	5	0	270 (250 - 360) ^a	150 (50-320) ^f	0	20 1, post-operative pancreatic bleeding	5 - 8	10 to 35 months; 4 patients obtained pain relief, 1 patient had reduced pain
Sahoo <i>et al.</i> [43]	2014	12	0	262.5 (210-310) ^a	NA	0	0	5 - 10	1 to 28 months; all patients obtained pain relief, all patients showed normal pancreatic anatomy by CT

^aMedian (range)

^bNA: Not available

^cSingle-site surgery

^dRobotic surgery

^eAll patients were children who underwent pancreatic ductal dilatation.

^fIncluding one patient who underwent the Beger procedure

pancreatitis, and it is thus difficult to determine whether a laparoscopic longitudinal pancreaticojejunostomy is less invasive compared to an open conventional operation.

Pain relief is the most important endpoint in evaluating the success of a longitudinal pancreaticojejunostomy for chronic pancreatitis [1-7]. In the present series, Tantia *et al.* [36] reported that 82% of their 17 patients were pain-free. In reports of more than 10 cases, Palanivelu *et al.* [37] reported the rate of 83% of complete pain relief, and Sahoo *et al.* [43] reported the rate of 100% pain relief. However, a consensus statement by the American Gastroenterological Association following a review of studies evaluating the conventional longitudinal pancreaticojejunostomy for chronic pancreatitis stated that 60%-70% of the patients achieved continued pain relief [31]. These findings suggest

that there are no significant differences between the laparoscopic and conventional procedures concerning pain control.

Another important endpoint is the preservation of pancreatic function. One of the postoperative advantages of longitudinal pancreaticojejunostomy compared to pancreatic resection for chronic pancreatitis is the preservation of the pancreatic function based on the preservation of the pancreatic parenchyma. Palanivelu *et al.* [37] reported that all 10 patients (100%) who underwent a laparoscopic longitudinal pancreaticojejunostomy achieved significant weight gain due to the improvement of their nutrition state. A recent systemic review by Yang *et al.* [52] supported early surgical treatment for chronic pancreatitis patients, not only for pain management but also

for a reduced risk of pancreatic insufficiency. In the near future, laparoscopic longitudinal pancreaticojejunostomy at the early stage will be justified as a minimally invasive treatment for chronic pancreatitis.

CONCLUSION

Laparoscopic longitudinal pancreaticojejunostomy is a feasible, safe and effective surgical procedure for chronic pancreatitis patients with a dilated main pancreatic duct in the absence of an inflammatory pancreatic head mass, as well as conventional open surgery. However, at the present time, laparoscopic longitudinal pancreaticojejunostomy is still in the early phase of introduction, and we recommend that this procedure is performed only in carefully selected patients by highly skilled laparoscopic pancreatic surgeons with an experienced surgical team at a high-volume pancreatic surgery center.

Conflicting Interest

There is no conflict of interest to report on the part of any author.

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