Laparoscopic distal pancreatectomy: critical analysis of preliminary experience from a tertiary referral centre

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Abstract

Background Laparoscopic pancreatic surgery has been slow to gain wide acceptance due to the complex pancreatic anatomy and physiology. The aim of this study was to analyze our preliminary results and highlight the impact of centralization on surgeon workload and pancreatic surgical innovation.

Methods A retrospective analysis was performed on all patients who underwent laparoscopic distal pancreatectomy from May 2007 to October 2008.

Results Laparoscopic distal pancreatectomy was performed in 17 patients during that period. Median operative time was 180 min (range 120–300 min). Median blood loss was 100 ml (range 50–500 ml). Splenectomy was performed in 12 patients. None of the patients was converted to open operation. All patients were kept in high-dependency unit for median duration of 1 day (range 0–1 day). One patient with previous cardiac disease was kept in intensive therapy unit for one night, but discharged home on 7th postoperative day without any complications. Postoperative recovery was uneventful in 13 patients, while four patients had pancreatic leak. One pancreatic leak was observed in the last 11 patients, in which pancreatic stump was oversewn. In three patients, pancreatic leaks (PL) were minor and settled with conservative management, while one patient needed a computed tomography (CT)-guided drainage and subsequent minilaparotomy for wash out of the intra abdominal collection. None of the patients died in this series. Median hospital stay was 5 days (range 4–7 days).

Conclusions Laparoscopic distal pancreatic resection is feasible, safe, and efficient. However, this surgery should only be performed in specialized centres with extensive experience in pancreatic and laparoscopic surgery. Oversewing the pancreatic stump after transaction with Endostapler may reduce the incidence of pancreatic leak. Centralization of pancreatic surgery has a positive impact on building up surgical expertise, resulting in obvious benefits for both patients and institutions.

Keywords Laparoscopic distal pancreatectomy ·
Pancreatic cancer · Pancreatic surgery · Pancreatic leak

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The advantages of minimal invasive techniques for the diagnosis and management of various surgical diseases are well known. Laparoscopic pancreatic resection has been slow to gain wide acceptance because of the difficult access to the delicate organ, its close relations with major vessels, and its complex physiology [1]. However, with the advancement in surgical technology and accumulation of advanced laparoscopic skills, pancreatic surgery is starting to gain popularity, especially for distal pancreatectomies [2–4].

In a recent review, 200 cases of laparoscopic distal pancreatectomy have been reported [5], but it is expected that the laparoscopic approach will be the gold standard for the treatment of lesions in pancreatic body and tail in near future. Centralization of pancreatic surgery appears to have

a positive impact on increasing the number of cases per surgeon, thus expanding surgical experience and improving results in this minimally invasive approach.

We discuss herein our experience and results since the centralization of pancreatic services to our hospital in May 2007, covering a population of 3.5 million in the south central coast of UK. Seventeen laparoscopic distal pancreatectomies have been performed during that period with an average of one procedure per month.

Materials and methods

A retrospective analysis was performed on all patients who underwent laparoscopic distal pancreatectomy from May 2007 to October 2008. The following data was studied: age, sex, preoperative investigations, indication of surgery, type, site and size of lesion, duration of surgery, blood loss, reason of conversion to open procedure, intra- and postoperative complications, duration of hospital stay, and distant events. Variables are presented as median and range.

The standard preoperative investigations [CT and magnetic resonance imaging (MRI)] were performed in all the patients, while endoscopic ultrasound with or without aspiration of tumor marker was performed in selected patients. All patients were reviewed at a weekly multidisciplinary meeting with radiologists, gastroenterologists, oncologists, and pathologists. During the study period all patients received antibiotic prophylaxis and low-molecular-weight heparin.

Postoperatively all patients were kept in surgical high-dependency unit for monitoring overnight. Oral fluid intake was instituted from the day of operation. Drain amylase was performed in all patients at postoperative day 2 and 5. Abdominal drains were removed if drain amylase was normal or drain output was less than 50 ml per day; in case of pancreatic leak (PL), drains were gradually pulled back on weekly basis until complete resolution of the leak. Subcutaneous octreotide (100 mg, three daily somministrations) and proton-pump inhibitor (PPI) were given to all patients. Patients were followed up in outpatient clinic at 1 week and 1 month after discharge from hospital, and depending on the pathology follow-up was scheduled. Pancreatic leak is defined as 30 ml output of fluid, with amylase content >3 times normal values, persistent for more than 7 days [5].

Operative technique

Under general anaesthesia, patients were positioned with left side up and ports were inserted as shown in Fig. 1. Abdomen was accessed under direct vision form port 1
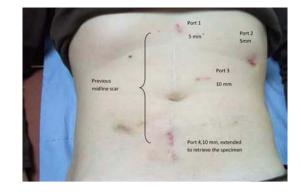

Fig. 1 Position of ports for laparoscopic distal pancreatectomy. (This patient had previous midline laparotomy for pancreatic necrosectomy)

using open Hasson technique to establish pneumoperitoneum. Four trocars were then placed under vision depending on the patient body habitus and location of the lesion (generally two 12-mm and two 5-mm trocars).

The gastrocolic ligament was divided up to the splenic flexure and good access to the lesser sac was obtained. In patients with spleen-preserving surgery, the short gastric vessels were preserved as long as possible. This was thought to leave the option to shift to Warshow's technique [6] if the splenic vessels could not be preserved; however, this was never needed.

All dissection was performed with ultrasonic dissector (Lotus™, Laparoscopic Operation by Torsional Ultrasound, Devon, UK). After division of adhesions between the posterior stomach wall and the pancreas, stomach was stitched and lifted through the epigastric port. Intraoperative ultrasound was performed in all cases to localize the lesion and define the extent of resection. Pancreatic dissection started by mobilizing the lower pancreatic margin 2 cm proximally to the lesion, gaining access to the post-pancreatic surface. Further dissection of the superior pancreatic border was performed to permit the placement of a tape around the pancreas. Lifting the tape, surgical plains become more evident and further dissection of the pancreas was then completed. The spleen was preserved in five cases. Spleen preservation was not attempted in the patients with lesions adherent to the splenic hilum and of malignant or potentially malignant nature. In these cases the splenic artery is dissected, slinged, and secured with Hem-o-lock (Weck Closure Systems, NC, USA) clips. A distal pancreatectomy was completed after dividing the pancreas ensuring clear resection margins using an endoscopic stapler (Echelon 60-Ethicon Endo Surgery, Cincinnati, OH, USA). In cases of splenopancreatectomy the spleen should be mobilized to be retrieved en block with the pancreas. The specimen was extracted through a 4-cm Pfanstiel in a leakproof endobag (Autosuture™, Norwalk, CT, USA). In one patient, the lower part of a previous incision was used

for specimen retrieval. In the last 11 cases the pancreatic stump was oversewn with interrupted 3/0 polydioxanone (PDS) suture. One Wallace drain was positioned near the pancreatic stump in all patients, and in patients with splenectomy another drain in left upper quadrant was also inserted.

Results

Nineteen patients with suspected pancreatic lesions were deemed operable; two patients with neuroendocrine tumors, invading the adjacent organs, needed multivisceral resection and underwent open resection. Rest of the remaining 17 patients had laparoscopic resection, performed by one hepatobiliary pancreatic surgeon (M.A.H.). Patients' demographic details, symptoms, and indication of resection are summarized in Table 1. All patients had CT and MRI scan before the procedure. Endoscopic ultrasound was performed in six patients to help in the characterization of the lesions. The commonest presenting symptom was abdominal pain followed by weight loss.

Median operative time was 180 min (range 120–300 min). Median blood loss was 100 ml (range 50–500 ml). Splenectomy was performed in 12 patients. All patients were kept in high-dependency unit, for median duration of 1 day (range 0–1 day). One patient with previous cardiac disease was kept in intensive therapy unit for one night, but discharged home on 7th postoperative day without any complications.

Postoperative recovery was uneventful in 13 patients, while four patients had pancreatic leak. In three patients pancreatic leaks (PL) were minor and settled with conservative management, while one patient needed a CT-guided

Table 1 Demographic and clinical characteristics of study population

Patients (n = 17)
Demographics
Age (years), median (range): 62 (17–76)
Sex (male:female): 5:12
Histopathology
Mucinous cystic neoplasm: 9
Neuroendocrine tumor: 1
Serous cyst adenoma: 3
MPD stricture due to chronic pancreatitis: 2
Pseudopapillary tumor: 1
Metastases from renal cell carcinoma: 1
Operative procedures: (distal pancreatectomy with)
Splenectomy 12 (70.6%)
Cholecystectomy: 1

drainage and subsequent minilaparotomy for wash out of the intra-abdominal collection. None of the patients died in this series. Median hospital stay was 5 days (range 4–7 days).

Discussion

The introduction of laparoscopic techniques was one of the most significant events in the evolution of surgery in the past century [4]. However, laparoscopic pancreatic surgery is still slow in gaining popularity. Only 200 cases have been reported since the first reported series of laparoscopic distal pancreatectomies by Gagner in 1996 [5, 7–12]. This slow expansion can be explained by the technical difficulty due to the posterior position of the pancreas, its relation to surrounding vessels, and moreover to the precarious pancreatic physiology and the high risk of postoperative complications, especially pancreatic leak. Open distal pancreatectomy usually requires an extensive abdominal incision even if the pancreatic tumor is small, while the minimally invasive approach offers significant advantages: reducing the parietal damage to the abdomen, acceptable complication rate, reasonably short hospital stay, and early return of patients to previous activities [13]. At present, there are no randomized studies comparing the open and the laparoscopic approach, but recent retrospective comparative studies confirmed the advantages of laparoscopic procedures [11, 14]. The indications for laparoscopic pancreatic resection are limited to benign or low-grade malignant diseases, in particular benign islet cell tumors, chronic pancreatitis, and cystic neoplasm [15]. The ability to obtain clear surgical margins and an adequate lymphadenectomy has long been a concern [16]. However, laparoscopic distal pancreatectomy has recently been carried out in patients with invasive carcinoma of pancreas [1].

The average reported conversion rate from laparoscopy to open operation is 14.1% (5–43%) [7, 17]. The commonly described reasons for conversion in the literature are obesity, dense omental fat, intraoperative bleeding, malignant disease requiring lymph node dissection, inability to detect the tumor, bulky tumor, and peritoneal adhesions due to previous surgery [17–20]. In this series no conversion was needed even in patient with dense peripancreatic and omental fat and in patients with previous pancreatitis.

Complete laparoscopic approach was also achieved in a young patient who previously had open pancreatic necrosectomy, which made surgery technically demanding due to loss of dissection plane [21]. The outcome of this article demonstrated positive impact of centralization of pancreatic surgery in UK. Centralization of pancreatic services has shown significant increase in surgeon workload and expertise, resulting in obvious benefits for both patients and

institutions. Several studies have suggested a better outcome for complex surgical procedures when performed in high-volume centers [22, 23]. This has led to the concept of centralization of major surgical procedures. The positive impact of pancreatic centralization is widely recognized [24–26], resulting in excellent outcomes in terms of morbidity, mortality, operative time, conversion rate, and blood loss.

Laparoscopic distal pancreatectomy raises two important issues: sparing the spleen with or without ligation of the splenic vessels, and the management of pancreatic remnant [7]. In the largest series of laparoscopic distal pancreatectomy, Mattolli et al. [7] have described a spleen-preservation rate of 55.1%. In our series spleen was preserved in five patients, though it was not considered in patients with large tumors close to the splenic hilum or with suspected malignancy, and it was not possible in patients with previous pancreatitis. Splenic preservation with the blood supply from short gastric arteries (Warshaw's method) has also been described in laparoscopic surgery [6], and is considered to be faster and less technically demanding than splenic vessel preservation but with the potential risk of splenic infarction/abscess [13]. This technique was not attempted in patients of our series. In our series we took utmost care to preserve the splenic vessels, but we also tried to spare the short gastric vessels as far as possible. This was thought to leave the option to shift to Warshaw's technique, if the splenic vessels were accidently damaged during manipulation; however, we never encountered such incidents.

Various methods of pancreatic transaction have been described in literature, but Endo-GIA stapler is the most preferred method, accepted by majority of authors [15], although linear stapler is limited in its use when a pancreas of more than 2 cm thickness is encountered [27]. Other techniques such as ultrasonic scalpel and absorbable, synthetic staple-line reinforcement material (Seamguard) have been used with good results by some authors [7, 27, 28]. In this series, pancreas was transected with endoscopic stapler (Echelon 60, Ethicon Endo Surgery, Cincinnati, OH, USA). The incidence of pancreatic leak in the first six patients was comparatively higher (50%), thus we decided to oversew the pancreatic stump with PDS 3.0 interrupted stitches, which is a routine method applied by some surgeons [29]. This technique is also routinely performed in the open operations.

The stitching was performed on the pancreatic remnant rather than onto the staple line as such. Results of this modification in the technique are encouraging, with one pancreatic leak (1/11) so far with oversewn pancreatic stump. However, we recognize that definitive conclusions cannot be drawn from this small series and no statistical analysis was performed. The contribution of other factors, such as improved surgical skills with the learning curve, cannot be overlooked.

The incidence of pancreatic fistula is variable among various series, because of different definitions used in different pancreatic centers [29, 30]. With the same definition, pancreatic fistula rate of 19% was observed in a prospective open distal pancreatectomy series [30]. Pancreatic leak was observed in four patients (23%) in this series. Three of them were successfully treated within 1 month with conservative management. One patient required minilaparotomy after unsuccessful percutaneous drainage of collection under CT.

Median operative time was 180 min in our series (range 120–300 min). Similarly, shorter operative time is described in recently published series, which can be explained by increasing experience of surgeons and the advancement in surgical instrumentation [7]. Median hospital stay in the present series was 5 days (range 4–7 days), which is similar to the other published series [14].

Conclusion

Laparoscopic distal pancreatic resection is feasible, safe, and efficient. Pancreatic leak continues to be the Achilles' heel for open and laparoscopic pancreatic surgeons. Oversewing the pancreatic stump after transaction with Endostapler may reduce the incidence. However, this surgery should only be performed at specialized centres with extensive experience in pancreatic and laparoscopic surgery. Centralization of pancreatic surgery has a positive impact in building up surgical experience, resulting in obvious benefits for both patients and institutions.

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