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Pancreatic Surgery in the Laparoscopic Era

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Summary

Recent advances in technology and techniques have opened the gates widely to a wide range of applications of minimally invasive surgery in patients with inflammatory and neoplastic diseases of the pancreas.

Laparoscopic cholecystectomy is the gold standard treatment for prevention of further attacks of acute biliary pancreatitis. Bile duct calculi detected at intraoperative cholangiography in patients with mild attacks of pancreatitis may be safely managed with laparoscopic bile duct exploration. Laparoscopic internal drainage of large, persistent and symptomatic pancreatic pseudocysts is safely applicable to most patients, achieves adequate drainage and facilitates debridement, and brings recognised benefits over open surgery and endoscopic approaches. Laparoscopic pancreatic necrosectomy for infected necrosis is feasible in some patients but the benefits of this approach in this high-risk group of patients remain to be shown.

Staging laparoscopy and laparoscopic ultrasound avoids unnecessary laparotomy in approximately one-fifth of patients with pancreatic cancer, but their routine application in patients with ampullary and duodenal cancers is not warranted. The majority of patients with periampullary cancer have locally advanced or metastatic disease at presentation and their management is entirely palliative. Laparoscopic surgery therefore has its place in the relief of biliary and gastric outlet obstruction, and has its advantages over endoscopic biliary and duodenal stenting in patients with predicted better prognosis, though these advantages ought to be confirmed in randomised controlled trials. Thoracoscopic splanchnicectomy is beneficial in the short-to-medium term for the palliation of intractable opiate-dependent abdominal pain of locally advanced pancreatic cancer and that of chronic pancreatitis with demonstrable improvements in quality of life.

Laparoscopic enucleation of neuroendocrine tumours of the pancreas, and distal or subtotal pancreatectomy with or without preservation of the splenic vessels and spleen for neuroendocrine and cystic tumours, and in some patients with chronic pancreatitis is feasible and safe. In experienced hands, this minimally invasive approach reduces postoperative hospital stay and expedites recovery. However, the incidence of pancreatic fistula following distal resection is not any less than that of open surgery. Although the previous limited experience with laparoscopic pancreaticoduodenectomy was discouraging, the recent experience with the hand-assisted approach is quite favourable and is likely to expand.

The application of diagnostic laparoscopy in patients with pancreatic cancer to detect peritoneal metastases and to obtain biopsy has been practiced since the early 1960s. Recent technological advances and technical developments have expanded the role of minimally invasive surgery (MIS), which now has its many applications in the management of patients with benign and malignant

pancreatic diseases. This role may be classified to include the prevention of further attacks of biliary pancreatitis, the management of complications of acute and chronic pancreatitis, and the staging, palliation and resection of pancreatic malignancies.

Gallstones account for the majority of attacks of acute pancreatitis in most countries. Failure to eliminate the biliary lithiasis risks further attacks in as many as 60% of patients within the initial 6 months [1]. Prevention is accomplished via a cholecystectomy in fit patients, which is recommended within 2-4 weeks of a mild attack [2]. Endoscopic sphincterotomy is reserved to unfit patients, as it reduces the risk of further attacks of biliary pancreatitis to 2-5% at two years [3, 4]. The laparoscopic approach to cholecystectomy is now the gold standard, and its application may be extended safely to include the elderly [5]. Indeed, patients recovering from acute biliary pancreatitis do not seem to be at increased operative risk compared with other patients undergoing laparoscopic cholecystectomy [6], although some increase in operative difficulty and time might be expected. With the advent of endoscopic ultrasound and its role in the detection of biliary microlithiasis, laparoscopic cholecystectomy may now be applied to the majority of patients whose attacks of acute pancreatitis were previously attributed to an 'idiopathic' aetiology [7].

The safety of laparoscopic bile duct exploration [8] has had its impact on the management of acute biliary pancreatitis. Routine intraoperative cholangiography with view to a laparoscopic bile duct exploration (where expertise is available) or a postoperative endoscopic retrograde cholangiopancreatography (ERCP) for choledocholithiasis should be the recommended practice. The adoption of preoperative ERCP should be highly selective considering that this procedure has its recognized rates of morbidity and mortality and that choledocholithiasis may be detected in only one of ten patients with recent acute biliary pancreatitis. Even in pancreatitis patients with a high risk for choledocholithiasis (dilated bile duct or persistent jaundice) and where expertise in laparoscopic bile duct exploration is lacking, a selective approach to postoperative ERCP based on a positive intraoperative cholangiography (positive in one of four patients) is favoured to that of a routine preoperative ERCP [9]. In a randomized controlled trial [9], selective postoperative ERCP was associated with a shorter hospital stay, reduced treatment cost, no increase in combined treatment failure rate, and significant reduction in ERCP use compared with routine preoperative ERCP. The routine application of preoperative ERCP in patients with mild acute pancreatitis and a low risk of choledocholithiasis [10] may now be considered medico-legally negligent.

Laparoscopic surgery has had its clear role in the management of pancreatic pseudocysts that complicate acute or chronic pancreatitis. Pseudocysts complicate 5-10% of acute attacks of pancreatitis and often arise as a result of disruption of the pancreatic duct in the presence of necrosis of the gland. Large (6 cm diameter or more), persistent (6 weeks or more) and symptomatic pseudocysts are indications for drainage, which is best achieved internally and in a dependent manner. Endoscopic trasmural (transgastric or transduodenal) drainage may be possible in some one third of patients with pancreatic pseudocysts, and is best reserved for pseudocysts that complicate chronic rather than acute pancreatitis, pseudocysts in the head or body of the gland, and those with a wall thickness of less than 1 cm [11].

Two important principles in the drainage of pseudocysts that complicate acute necrotizing pancreatitis are the debridement of necrotic tissue within the pseudocysts and their 'adequate' drainage into the gastrointestinal tract. Endoscopic drainage, by enlarge, fails to achieve these principles, hence the potential for blockage of the drainage tubes by debris within the pseudocysts with the risk of secondary infection and sepsis [12]. These two principles are best served through surgical drainage and debridement. Indeed,

surgery remains the gold standard of management of large, persistent and symptomatic pseudocysts against which new modalities of therapy ought to be compared. Internal drainage is conventionally achieved through a pseudocyst-gastrostomy or pseudocyst-jejunostomy, procedures that are now safely and effectively accomplished laparoscopically. Transgastric (through an anterior gastrostomy) [13], endogastric [14, 15], exo-gastric (posterior approach through the lesser sac) [16], as well as Roux-en-Y pseudocyst-jejunostomy [17] have been described. Whilst there are no randomized controlled trails comparing the laparoscopic and open approaches to internal drainage of pseudocysts, it is important to realize that the only difference between the two approaches resides in the method of access through the abdominal wall and not in the surgical principles applied. In experienced hands therefore, patients are better served by the MIS approach, which is associated with a relatively short postoperative hospital stay (average of 3-4 days) and a rapid recovery [13, 14, 15, 16, 17].

Secondary infection of pancreatic necrosis carries a high mortality and, if confirmed by fine-needle aspiration, is the absolute indication for pancreatic necrosectomy [18]. MIS techniques of pancreatic necrosectomy have been described and include a lesser sac, a trans-mesocolic, a transgastric and retroperitoneal approaches [19, 20, 21]. However, the world experience with these techniques remains limited, and the benefits of the MIS in this high-risk group of patients remain to be demonstrated. A highly selective approach to MIS necrosectomy should therefore be exercised.

In the modern era of cross-sectional imaging, the routine use of laparoscopy for the staging of non-pancreatic periampullary malignancies has been questioned. Whilst staging laparoscopy may spare some one-fifth of patients a laparotomy, its use in patients with ampullary and duodenal cancers does not appear warranted [22, 23]. The addition of laparoscopic ultrasound may be beneficial in the detection of intrahepatic metastases and vascular involvement in patients with pancreatic cancer. However, it is largely operator-dependent and its availability remains restricted to a few centres.

Some four-fifths of patients with pancreatic and other periampullary malignancies present with locally advanced or metastatic disease, and their management is entirely palliative [24]. A substantial proportion of patients will present with biliary obstruction and some 10-20% of patients will have symptoms of gastric outlet obstruction [24, 25]. These patients have traditionally been managed by a laparotomy and gastric and biliary bypass. More recently, however, minimally invasive laparoscopic approaches to gastric and biliary bypass have been successfully applied, and were shown in non-randomised comparative studies to be safe and associated with significant reductions in hospital stay compared with open surgery [26, 27, 28].

Although a hepaticojejunostomy is significantly more likely to remain patent compared with a cholecystojejunostomy [29], the technical ease and safety of the latter favours its more frequent laparoscopic application. It is essential however to confirm patency of the cystic duct by preoperative (ultrasound, computed tomography, magnetic resonance cholangiography, or endoscopic or percutaneous cholangiography) or intraoperative imaging (cholangiography or laparoscopic ultrasonography). Percutaneous transhepatic biliary stent insertion may be reserved to the small proportion of patients in whom the cholecystojejunostomy fails during follow up. However, insertion of the cystic duct within less than 1 cm from the proximal end of the biliary stricture may favour a hepaticojejunostomy, particularly in the good prognosis patient (elderly women with locally advanced rather than metastatic disease).

Within the context of minimally invasive management of gastric and biliary obstruction, the role of endoscopic techniques ought to be considered. Endoscopic biliary stent insertion may achieve success rates of short-term relief of obstructive jaundice that are similar to those of open bypass surgery and with reduced morbidity and hospital stay

[29]. However, plastic endoprostheses, unlike metal stents, are associated with considerably greater long-term morbidity (largely due to their occlusion, cholangitis and need for stent replacement) compared with bypass surgery in patients surviving longer than 6 months (60% versus 5% in one study) [30]. Moreover, their short-term advantage over open surgery may well be lost when compared with laparoscopic surgery. Hence, a randomised comparison between laparoscopic biliary bypass and metal biliary stents in good prognosis unresectable patients with periampullary cancer is warranted.

Endoscopic placement of metal self-expandable duodenal stents has been described and is associated with high success rates in relieving the obstruction, and lower morbidity and post-intervention hospital stay compared with a laparotomy [25]. Unlike the surgical gastric bypass, which hardly obstructs before death [31], tumour ingrowth into the stent or stent migration may lead to recurrence of the duodenal obstruction in some one-quarter of patients [32]. A randomised clinical trial comparing the laparoscopic and endoscopic techniques is therefore justified.

Bilateral thoracoscopic splanchnotomy, a MIS procedure that involves the division of the greater and lesser splanchnic sympathetic nerve afferents that convey pain sensation from upper abdominal viscera, has had its recognised role in the palliation of intractable abdominal pain of chronic pancreatitis [33] and pancreatic cancer [34]. Most patients who underwent thoracoscopic splanchnicectomy were able to reduce their dosage of opiates, and had significantly less pain and better quality of residual life after the procedure [33, 34]. Better results are seen with bilateral than unilateral splanchnicectomy, and when the procedure is applied to cancer patients than those with chronic pancreatitis as the potential duration of pain relief achieved often outlives the limited life expectancy of cancer patients. The pain may be expected to recur to its preoperative level in some half of the patients with chronic pancreatitis after 2-5 years of follow up [33].

Neuroendocrine and cystic tumours of the pancreas and, to a lesser extent, chronic pancreatitis represent the best indications for laparoscopic distal pancreatic resection. Preoperative imaging and intraoperative laparoscopic ultrasound are essential for accurate localisation of neuroendocrine tumours [35]. MIS is favoured for this pathology, as the specimen to remove is relatively small and contrasts greatly with the large size of abdominal incision required to access this retroperitoneal gland at open surgery, there are no anastomoses to fashion, and the pathology is, by enlarge, benign. Indeed, in selected patients and in experienced hands, laparoscopic surgery (enucleation, distal or subtotal pancreatectomy) appeared to be associated with short postoperative hospital stay and rapid recovery [36]. Preservation of the splenic vessels and spleen during distal pancreatectomy is often possible. The risk of pancreatic fistula however is not reduced, and the application of tissue glue might be of some benefit.

Pancreaticoduodenectomy, on the other hand, is a more challenging operation, and involves the construction of a number of anastomoses and the retrieval of a large specimen. Although the limited world experience with laparoscopic pancreaticoduodenectomy has been discouraging, the recent development of laparoscopic hand ports has revived interest. Indeed, the early experience with the laparoscopic hand-assisted pancreaticoduodenectomy [37], including ours, has been quite favourable, and is likely to expand.

Minimally invasive laparoscopic and thoracoscopic surgery has established a substantial role in the management of inflammatory and neoplastic diseases of the pancreas, and its applications will undoubtedly increase with further developments in technology and techniques, and with the expansion in training in MIS.

Keywords Biliary Tract Diseases; Laparoscopy; Palliative Care;

Pancreatectomy; Pancreatic Diseases; Pancreatic Neoplasms; Pancreatic Pseudocyst; Pancreaticoduodenectomy; Pancreatico-jejunostomy; Pancreatitis; Pancreatitis, Acute Necrotizing; Pancreatitis, Alcoholic; Thoracic Surgical Procedures

Abbreviations MIS: minimally invasive surgery

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