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Central Pancreatectomy: A Center of Debate of Risk versus Benefit

Norman Oneil Machado*

Depratment of Surgery, Sultan Qaboos University Hospital, Muscat/ Oman

***Corresponding author:** Norman Oneil Machado, Depratment of Surgery, Sultan Qaboos University Hospital, PO Box 38, Postal Code 123, Muscat/ Oman, Tel: + 00968 99432723 ; E-mail: oneilnorman@gmail.com

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Introduction

Central Pancreatectomy (CP) is a parenchyma sparing operation, which involves segmental resection of the pancreas [1-4]. This is most appropriate to advocate in removal of benign and low-grade malignant lesions, arising from the neck and proximal body of the pancreas [4-13]. Such lesions would have traditionally required pancreaticoduodenectomy or distal pancreatectomy [4,6]. These procedures while oncologically sound, involves resection of considerable amount normal parenchyma. Recent literature however has frequent reports of CP being performed for such low grade or benign tumours [1-13]. CP, when compared to traditional resection, achieves significant sparing of normal pancreatic parenchyma and is believed to offer better preservation of pancreatic function with acceptable morbidity and mortality [3-7,12]. The debate however is, what are the benefits and long/short term complications of CP and does the benefit outweigh the risk?

Historical Perspective

Ehrhardt in 1908 described segmental resection. This was followed by a report in 1910 by Finney, without performing the reconstruction part [1]. Guillemin and Bessot carried out CP in 1957, for a patient with chronic pancreatitis, where two pancreaticoenteric anastomosis was carried out [13]. In 1959, Letton and Wilson reported CP for a patient with traumatic transection of the pancreas, describing suture of proximal stump and pancreaticojejunostomy of the distal segment [14]. Dagradi and Serio performed the first CP for pancreatic neoplasm in 1984, where a benign insulinoma was resected [1]. Subsequently Iacono validated it with functional endocrine and exocrine tests and popularized worldwide [1]. Since then several case reports/ and series have appeared in the literature [1-13]. Several terms have been used to describe this procedure and include middle pancreatectomy, median pancreatectomy, medial pancreatectomy, segmental pancreatectomy, limited conservative pancreatectomy and intermediate pancreatectomy. It is however often referred to as central pancreatectomy [1].

Indication

The frequent use of radiological imaging for assessing abdominal symptoms has led to the detection of pancreatic lesions, which are benign or of low grade [3,6,8,11,12]. This has driven to the use of parenchyma sparing techniques such as enucleation and central (middle) pancreatectomy. The lesions that usually undergo CP are those that are benign, low-grade malignant tumours of the pancreas, or solitary pancreatic metastasis from other tumours [3,6,8,11,1]. While benign or low-grade lesions could also be dealt by enucleation, those that are most suited for CP among these are the ones with unfavourable position for enucleation, due to its proximity to the pancreatic duct. In addition, lesions more than 2 cm in size or those with a risk of inadequate removal are also appropriate for CP [6,12]. The extent of resection of benign tumours such as serous cystadenoma and mucinous cystadenoma is influenced by its size. However as only a small segment of tumour free margin is sufficient to prevent recurrence in them, these lesions can be resected with significant amount of pancreatic parenchyma preservation. Successful resections of lesions by CP include insulinoma [6], solid pseudopapillary tumours [2] and IPMN [6]. The concern however is the risk of recurrence in patients with IPMN, due its nature of diffuse ductal lesions [6]. Fortunately it is low and was reported to be 3.3% (1 out 26 cases) [6].

The contraindications for this procedure include malignant tumours, especially ductal adenocarcinoma [1,15]. Because of the limited extent of surgery and the lack of sufficient lymph node dissection in CP, it is not oncologically appropriate for invasive adenocarcinoma. Hence, CP should not be considered even if there is a remote possibility of the lesion being adenocarcinoma6. In addition to being unable to carry out a R0 resection in such lesions, there is also a risk of dissemination, if the tumour mass is breached during dissection [3,6,8]. The other contraindications include neoplastic involvement from other organs (e.g. stomach or colon), diffuse chronic pancreatitis, inability to preserve at least 5 cm of distal pancreatic stump due to a large lesion, distal body–tail atrophy and Melliere and Moulle type 111 pancreatic vascularization where the body–tail of pancreas receives its blood supply exclusively from the transverse pancreatic artery, left branch of the dorsal pancreatic artery [1,15].

Technical Issues

After incision of superior and inferior margins of pancreas, the segment of the pancreas harboring the lesion is mobilized and the pancreas is isolated at its superior margin from the splenic artery, ligating and severing some collateral vessels. Subsequently, the posterior surface of the pancreas is carefully dissected from the splenic vein, taking care to avoid its injury. After placing marginal stitches on the cephalic and distal side, the pancreas is transected. The resected specimen is sent for frozen section to ensure that the resection margins are tumour free [1]. The Pancreatic duct on the proximal segment is sutured with non-absorbable sutures. Alternatively, it could be stapled. The distal segment is sutured to a Roux-en Y loop of jejunum, either end to side (mucosa of gut to duct mucosa, when the duct is > 4 mm in diameter and pancreas is firm) or by invagination technique, when the duct size and pancreas texture is not favourable for direct anastomosis [16] (Figure 1). Some would carry out a gastropancreatic anastomosis of the distal segment [3].

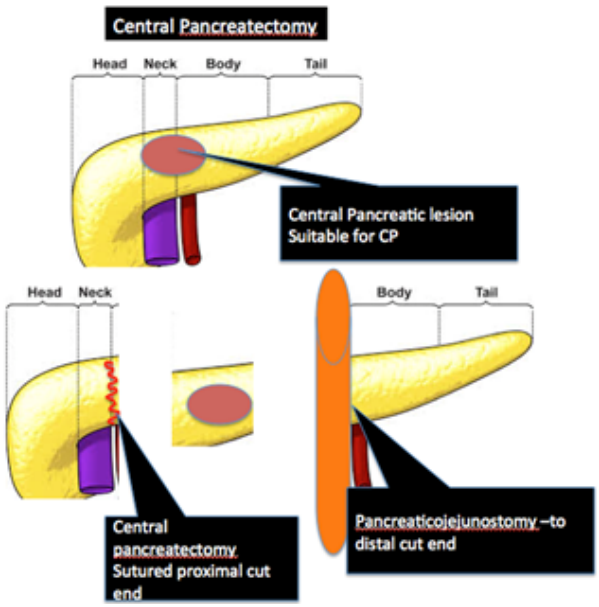

Figure 1: Diagram showing central pancreatectomy for a lesion in the neck/proximal body of the pancreas. The proximal cut end is sutured and the distal cut end shows end to side pancreaticojejunostomy.

Laparoscopic central pancreatectomy has been reported to be carried out in over 51 cases in the literature [2,7,9,17]. However though feasible and safe, it is presently restricted to few specialized centers because of the complexity of performing the surgery [17]. Presently the mean operative time is longer (356 minutes), the rate of pancreatic fistula is significant (46%) and the mean hospital stay is not reduced (13.8 days) [17]. With more experience gained, these outcomes could be influenced positively.

Morbidity and mortality

One of the major deterrents to the widespread acceptance of CP among pancreatic surgeons is the concern of high rate of complications, especially pancreatic fistula [6,12,18]. The reported incidence of pancreatic fistula ranges from 0-63% and the fistula requiring reoperation from 0-18% [5,18-20]. In a recent systemic review involving 207 patients from 16 different centers, the overall morbidity was 33% and reported fistula rate 22% [6]. However, in most reports, the fistula rate is greater than 30%. Some report even a higher complication rate with a morbidity of 60% and overall pancreatic fistula rate of 50%. Majority of the pancreatic fistula in most series though, is grade A [5,6,8,11]. The leakage could occur both from the closed cut end of the pancreas head and the pancreaticoenterostomy site [21]. The probable factors could be that these lesions are generally small and would not have impinged on the duct; hence the duct is likely to be of smaller caliber and pancreas of softer texture, both increasing the risk anastomosis leak [6,21]. The comparison of outcome of CP with Distal Pancreatectomy (DP) is prudent. Some reports have found no difference between the CP and DP with regard to intra-abdominal collections and need for radiological interventions, non-surgical complications and readmissions. The only difference noted was greater need for reoperation in DP group (7%) [6,11]. Reports also note of lower blood loss following CP compared to DP11. In addition, CP facilitates the preservation of spleen and hence it's immunological function and maintains the physiological and anatomical integrity of duodenum and pancreatic biliary drainage. However the duration of surgery is longer as is the hospital stay [6,11,12]. In general the perioperative mortality rate was lower and is reported to be 0.97% following CP [17]. The mean operating time for CP is between 183 to 264 minutes and the volume of blood loss is 382 to 497 ml [11].

The difference in the outcome has also been related to the type of anastomosis. The most widely used reconstructive technique after CP is pancreaticojejunostomy (PJ) (87.6%), although some centers often carry out pancreaticogastrostomy (PG) (12.4%) [3]. In one study, complications the pancreatic fistula were more often seen after pancreatico-gastrostomy than pancreatico-jejunal anastomosis [3]. While some of the observational studies have reported lower incidence of pancreatic fistula in patients undergoing PG compared to PJ [3]. The incidence of exocrine deficiency however is reported to be higher because of the obvious influence of gastric juice on the enzymes [3]. Randomized controlled trials and systematic review have shown no significant difference between PJ and PG after PD regarding the overall postoperative complications, including pancreatic fistula, intra-abdominal fluid collection and mortality [21]. The postoperative mortality ranges from 0% to 2% [3].

The real test of the benefits of CP is measured however in terms of its goal in preserving the endocrine and exocrine function. The reassuring aspect of the outcome of CP is that multiple reports stress the good long-term functional results as a consequence of preserving pancreas parenchyma and the duodeno pancreas complex [5,6,8,11]. This ensures preservation of endocrine and exocrine function [5,6,8,11]. The endocrine function is assessed in terms of the development of new onset diabetes or worsening of concurrent diabetes [5,11]. The exocrine function is assessed by clinical manifestations and the need for taking enzymes. Using these criteria the incidence of both new endocrine and exocrine insufficiency was significantly higher in the DP group compared to CP, with a 9-fold increase of new onset diabetes (38% vs. 4%, p=0.0001) and a threefold increase in exocrine insufficiency (15.6% vs. 5%, p=0.039)11. In another series, 9.9% of overall patients developed pancreatic insufficiency after CP, and this incidence further increased in the presence of chronic pancreatitis [4]. CP was associated with lower cumulative incidence of this complication compared to DP (11.9 versus 19.1%) [4]. The good results of exocrine and endocrine function have been reported in several series [5,6,8,19]. These results are also impressive when one considers the incidence of diabetes mellitus is 10-24% after PD and 8-60% after DP [22,23]. The outcome of CP is summarized well in a meta-analysis involving nine studies with 735 patients comparing the outcome of CP with DP [11]. The observations made were that in CP the operative time was longer than DP, but there was no significant difference in the volume of intra-operative blood loss, blood transfusion and length of postoperative stay [11]. CP however had a higher overall post-operative complications rate (Fixed effects model: RR: 1.30; 95% CI 1.05-1.62; $p<0.05$), pancreatic fistula rate (Fixed effects model: RR: 1.58; 95% CI: 1.20-2.08; $p<0.05$). Importantly, the two groups did not differ significantly in fateful surgical complications such as clinically significant pancreatic fistula (grades B and C), postoperative bleeding, reoperation and intra-abdominal effusions/abscess [11]. The perioperative mortality rate was also comparable. During the follow up period, the patients after DP were more likely to suffer pancreatic exocrine insufficiency (fixed

effects model: RR: 0.53; 95% CI: 0.32-0.86; p<0.05) and endocrine impairment (Fixed effects model: RR: 0.19; 95% CI: 0.11-0.33; p<0.05). In addition, both endocrine and exocrine deficiency takes significantly longer time to develop in the CP group [11]. A comparison in terms of the enzyme substitution between CP (4%) and right pancreatectomy (32%) is also favorable [6,11].The incidence of exocrine insufficiency after pancreatic resection however varies significantly and is influenced by the pre-existing pancreatic abnormalities and the extent of pancreatic resection. In the presence of chronic pancreatitis this ratio increases to as high as 40% after PD and to 85% after DP [24,25].

Concern of Local Recurrence

One of the concerns of limited resection is the potential risk of local recurrence. The overall local disease recurrence is reported to be 3.3% [6]. While CP is advocated in several benign and low grade malignant lesion, the risk of recurrence is most likely in patients with IPMN due to the nature of the disease involving the duct diffusely [6]. On table frozen section analysis of the resected margin for dysplasia or positive margin and intraoperative pancreaticoscopy to inspect the duct for residual lesions are some of the measures that could be advocated to reduce this risk [26]. The preference of PG anastomosis by some facilitates the inspection of pancreatic duct so that recurrence could be detected by endoscopy and biopsy, during surveillance [26,27]. Moreover use of endoscopic ultrasound and pancreaticoscopy is feasible in patients with PG [26,27].

Conclusion

CP is a safe and organ preserving option for benign or low-grade malignant lesion in the neck and proximal body of the pancreas. Several reports including meta-analysis note that the complications of CP are comparable with distal pancreatectomy, a procedure with more extensive parenchymal resection. Even though the concern of pancreatic fistula exists, they are usually of minor nature and are managed conservatively. Importantly, based on the present evidence, CP offers better long-term preservation of pancreatic endocrine and exocrine function and hence is an option that should be considered in suitable lesions. Hence the benefits outweigh the risk when CP is carried out for appropriate lesions.

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