



## Central Pancreatectomy as a Paradigm of Parenchyma-Sparing Resection of the Pancreas

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### Introduction

Traditional surgical resections of the pancreas are commonly represented by pancreaticoduodenectomy (PD), distal pancreatectomy (DP) with or without splenectomy and total pancreatectomy, depending on tumor's location. Nowadays, mortality and morbidity rates after pancreatic resection account for 3% and 30%, respectively [1]. These surgical procedures result in an important loss of normal pancreatic parenchyma that can frequently lead to the onset of exocrine and/or endocrine pancreatic failure. Typical resections are the treatment of choice for malignant diseases, but they can be considered excessive for benign conditions or border-line neoplasms, especially if performed in young and otherwise healthy patients. In order to overcome these problems, parenchyma-sparing surgical procedures have been suggested. However, limited resections are justified if surgical risk is not higher and long-term outcome is better compared to standard procedures after the preliminary experiences in the early 2000s, parenchyma-sparing surgery have been increasingly proposed with the aim to preserve pancreatic function. Neoplasms of the middle portion of the pancreas not suitable for enucleation, can be successfully treated with central pancreatectomy (CP), also known as medial pancreatectomy, middle segment pancreatectomy and median pancreatectomy.

### Surgical Technique

Central pancreatectomy is the most frequent parenchyma-sparing procedure of the pancreas performed worldwide: its popularity may be explained by the standardization of the technique and the increasing number of tumors incidentally detected by imaging procedures. Surgical technique includes resection of the mid-portion of the pancreas (Figure 1), suture of the proximal stump of the pancreas and anastomosis of the distal stump with a Roux-en-Y jejunal loop (Figure 2) or with the posterior wall of the stomach. Frozen section examination of both sides of resection is mandatory (Figure 3).

### Surgical Risk

Post-operative mortality is comparable with that of traditional resections, but complications may frequently occur. In the literature, morbidity rates ranged widely from 0 to 92% [2,3] and, in our experience, it was 52% [4]. The onset of pancreatic fistula is the main post-operative complication (range from 0% to 64%) [4] since, in most of the patients, the residual pancreas is normal with a small main pancreatic duct. Pancreatic fistula can occur as a leakage of the pancreatico-jejunosomy or of the pancreatic stump [5]. Other post-operative complications are relatively rare: delayed gastric emptying, infarcts in the distal pancreas and spleen, pancreatic pseudo cysts have been reported [6-9].

Wolk et al. [10] compared mortality and morbidity rate of a group of patient who underwent CP to another group who underwent pancreatic enucleation (PE). Perioperative mortality was 0% in both groups while morbidity was 80.8% for CP and 82.4% in patient who underwent PE. Post-operative fistula was the most frequent complication (26.9% in CP, 35.3% in PE) but without statistical differences among the two groups. Goudard et al. [11] reported an overall morbidity rate of 72% with a mortality rate of 3%. As expected, pancreatic fistula was the main cause of postoperative complications.

### Long-term Results

The principal advantage of CP compared to standard resections is the preservation of pancreatic functional parenchyma; this can prevent the development of de-novo diabetes or exocrine failure, or the worsening of the pre-existing pancreatic insufficiency. Better functional results have been

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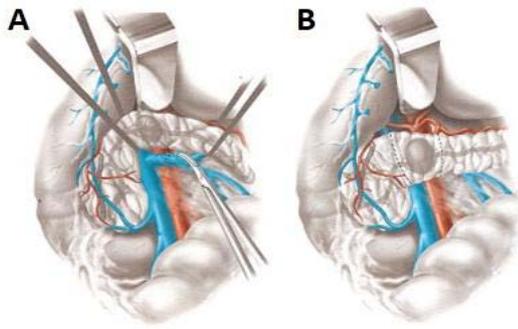
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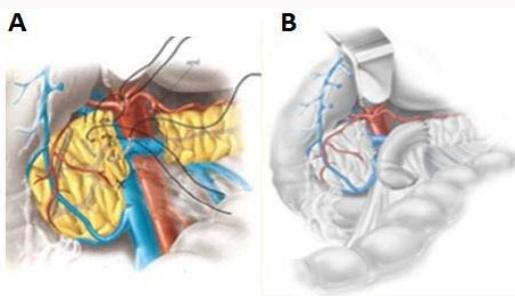
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**Figure 1:** A) Surgical technique of central pancreatectomy: isolation of the body of the pancreas to the retro-pancreatic tissue; B) Isolation of the neoplasm and section of the pancreas with a margin of resection of at least 1 cm from the lesion on both sides. Splenic vessels are preserved.



**Figure 2:** A) Surgical technique of central pancreatectomy: proximal stump of the pancreas is sutured with interrupted stitches or with a stapler; B) Distal stump is generally anastomosed end-to-end or end-to-side with a Roux-en-Y jejunal loop.

reported in patients undergoing CP compared to patients undergoing PD or DP [12-14]. In the experience of Goudard et al. [11], long-term results after operation were excellent: new-onset diabetes occurred in 2% of patients and preexisting diabetes worsened in 5%. Surprisingly only 6% of patients showed exocrine pancreatic insufficiency despite pancreaticogastrostomy reconstruction, a procedure that worsens pancreatic exocrine function [11,15]. Moreover, all hospital deaths occurred in old patients, aged 68-year or older. Age and performance status of the patient seem to be prognostic risks factor of post-operative mortality. In a recent meta-analysis of central pancreatectomy, Iacono et al. [16] reported an overall mortality rate of 0.8% (5/633 patients) and 2 out of the 3 valuable patients who died, were old (69 and 71-year old, respectively). In our experience of 40 central pancreatectomies [4] the single postoperative death occurred in a 78-year old patient who experienced an abdominal abscess and multiorgan failure after resection for renal cell cancer metastasis.

## Indication

Currently there is no clear consensus on surgical indications for CP as well as for other atypical resections. Santangelo et al. [17], recently published a systematic review of the literature evaluating surgical indications, mortality and morbidity of CP. He found that CP can be indicated for pancreatic trauma, chronic pancreatitis and small, not needing lymphadenectomy, neoplastic processes. So, indications for CP includes: 1) tumor's size <5; 2) benign or low-grade primary malignant tumors such as endocrine tumors, intraductal papillary mucinous neoplasms, mucinous cystadenomas, serous cystadenomas and solid-pseudopapillary neoplasms; 3) non-neoplastic cysts not



**Figure 3:** Surgical specimen of CP.

suitable for enucleation; 4) isolated metastases to the pancreas; 5) focal chronic pancreatitis with Wirsung's duct stenosis; 6) pancreatic trauma. Atypical resections are not obviously indicated for frankly malignant neoplasms because of high risk of recurrence; in the experience of Goudard et al. [14] 10 patients had malignant tumors, and 3 of them showed tumor's recurrence (2 renal cell cancer and 1 endocrine tumor). Iacono et al. [16] reported a tumor's recurrence in 18 out of 539 (3.3%) patients collected from the literature. In our experience we found a tumor relapse in the distal pancreas 5 years after central pancreatectomy in a patient with metastatic renal cell cancer. So, the indication for parenchyma-sparing pancreatectomy should be carefully evaluated in order to minimize the risk of under treatment or relapse of the neoplasm.

## Conclusion

In conclusion, CP can be considered a feasible and safe technique for selected patients, especially for young and previously healthy subjects. It has a role in the treatment of benign or border-line lesions of the pancreas: excellent pancreatic function is provided in almost all patients, but clinicians should be aware that a troubled postoperative course may occur in nearly half of the patients. Careful selection of the patients, accurate pre- and intra-operative evaluation of the lesion, and expertise in pancreatic surgery are essential to obtain the best outcome.

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