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Middle Segment Pancreatectomy: A Useful Tool in the Management of Pancreatic Neoplasms

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Abstract
Small, benign or low grade malignant tumours located in the neck of the pancreas are usually treated with enucleation. However if enucleation is too risky because of possible damage to the main pancreatic duct, standard pancreatic resections are performed. Such operations can lead to impaired long term exocrine-endocrine function. Middle segment pancreatectomy consists of a limited resection of the midportion of the pancreas and can be performed in selected patients affected by tumours of the pancreatic neck. Middle segment pancreatectomy is a safe and feasible procedure for treating tumours of the pancreatic neck; in experienced hands it is associated with no mortality but with high morbidity; the rate of "clinical" pancreatic fistula is about 20%. Moreover, it allows the surgeon to preserve pancreatic parenchyma and consequently long term endocrine and exocrine pancreatic function.

Keywords Pancreatic resection · Middle segment pancreatectomy · Pancreatic tumours · Surgical complications · Pancreatic function

Introduction

While neoplastic lesions located in the pancreatic head or body-tail are usually resected by pancreaticoduodenectomy or distal pancreatectomy, tumours in the neck represent a real challenge for the surgeon. In these cases, standard or extended pancreatectomies performed for benign or borderline cases, can result in the loss of a great amount of glandular tissue, significantly increasing the risk of diabetes, impaired exocrine function and splenic loss[1–6].

Enucleation would be an adequate alternative for small, benign and low-grade malignant tumours, such as endocrine and cystic neoplasms of the pancreas. Unfortunately this conservative procedure is not always applicable. When the neoplastic lesion measures up to 2 cm or more, or is encased within the pancreatic gland, enucleation is associated with a high risk of Wirsung's duct damage; moreover in the case of tumours with uncertain biological behaviour this approach shuld be avoided because of the risk of tumour recurrence[1–5].

Letton and Wilson reported for the first time in the English literature in 1959 two cases of traumatic mid-pancreatic transection followed by a reconstruction with a Roux-en-Y jejunal loop anastomized to the distal part of the gland[7]. Dagradi and Serio, form our own Department of Surgery, were the first in 1984 to propose middle pancreatectomy with an "oncological" indication, treating a pancreatic insulinoma[8]. Subsequently, other Authors reported cases of resection of the middle pancreas, of varying extent, using various terms such as "central pancreatectomy", "middle segment pancreatectomy", "segmental pancreatectomy" and "intermediate pancreatectomy"[9–13]. The underlying indications for surgery ranged

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from chronic pancreatitis to benign, uncertain behaviour or low- grade malignant exocrine and endocrine neoplasms[1–19]. Different tecniques were adopted for gastrointestinal reconstruction including jejunal anastomosis of boh the proximal and distal stump, or of only the distal stump, with pancreaticojejunal or pancreaticogastric anastomosis[1–21].

Surgical Technique

The abdomen is entered through a midline incision. The gastrocolic ligament is opened, preserving the gastroepiploic vessels, and the pancreatic gland is exposed. The posterior peritoneum along the superior and inferior margin of the pancreas is incised. The superior mesenteric vein and the portal vein must be identified and their surfaces cleared below the gland. The plane between the superior mesenteric and portal vein should be teased apart. The splenic artery and vein are dissected free and separated from the gland. Some venous tributaries to the portomesenteric axis and some minor collaterals of the splenic artery can be ligated. Then, the posterior surface of the pancreatic neck is isolated from the portomesenteric axis and a ribbon is passed behind the gland to elevate it. Sutures are placed along the superior and inferior margins to indicate where the proximal and distal transection should be performed and to ligate those wessels running along the margins. The segment of the pancreas with the tumour is subsequently transected through a knife or a stapler to the left and to the right of the lesion. The cephalic stump is sutured with interrupted stitches after elective ligation of Wirsung's duct or by means of a stapler. A small stent is placed in the main pancreatic duct while performing pancreojejunal or pancreogastric anastomosis; the stent can be left in place. Two closed-system suction drains are used to drain the cephalic stump of the gland and the pancreojejunostomy or pancreogastrostomy.

Discussion

It has been demonstrated that standard pancreatic resections are nowadays associated with low mortality and morbidity if performed in high-volume centres by experienced surgeons[22–24]. It is also known that this type of surgery can lead to long-term complications, such as diabetes, exocrine insufficiency and late postsplenectomy infection[25,26].

The incidence of postoperative exocrine and endocrine impairment is not predictable in patients with apparently "normal pancreas". Factors such as fibrosis of the remnant, Wirsung duct obstruction, preexisting chronic pancreatitis, benign or malignant disease and subclinical diabetes may play a role as "risk factors"[1–3]. After a standard left-sided resection there is an increased incidence of endocrine impairement and diabetes onset reported in from 17 to 85% of patients: it is obvious that the extent of the resection is strictly related to the incidence of endocrine-exocrine long-term insufficiency[27–31].

For all these reasons, more conservative surgical techniques have been advocated for small, benign or low-grade malignant tumours located in the neck of the gland, aimed at sparing as much as possible of pancreatic parenchyma; whenever neoplastic lesions are not small and superficial enought to be simply enucleated, middle segment pancreatectomy should be considerated[1–6].

Middle segment pancreatectomy accounts for only 3% of the pancreatic resections performed at our Institution and about 100 cases have been reported in the English literature[1–21,32–34]: this means carefull patients selection. The small number of patients who have undergone this type of opeation is related to different factors: specific localization of the neoplasm, well selected indications (benign or low-grade malignant tumours) and a distal pancreatic stump of at least 5 cm in length.

Some authors[1,3] have reported that this operation should be performed only for small tumours (<5 cm in diameter); in our experience, although the mean diameter of the resected lesions is 27.4 mm, we have safely performed middle segment resection for tumours measuring more than 5 cm, arising from the anterior surface of the pancreas.

We have also used middle segment pancreatectomy occasionaly for malignant disease: two islet cell carcinomas, one vipoma who subsequently developed hepatic metastases, one cystadenocarcinoma and one carcinoma in situ[2,3,10–12].

In the past, we have also performed this operation for more malignant tumours, but we have had pancreatic recurrence of the tumor in two patients (one affected by metastasis and one by IPMN with in situ carcinoma); moreover two patients with adenoma and borderline main duct IPMN, had a tumour recurrence in the pancreatic gland. Thus, we believe that in patients affected by primary or metastastic malignant tumours, a standard resection would be more appropriate. Moreover, middle pancreatectomy in our experience should be avoided also in patients affected by IPMN, especially main-duct type, because of their potential malignancy and the possibility of different degrees of dysplasia along the duct.

The surgeon must be sure to achieve tumor-free proximal and distal resection margins after performing middle segment pancreatectomy and for this reason frozen section examination is mandatory.

Middle segment pancreatectomy is a meticolous procedure. There is the possibility of leaks from both the closed cut edge of the head and the pancreojejunostomy, particu-

larly since in most patients we are dealing with a normal soft pancreatic texture with a small Wirsung duct. Thus, not only great care must be taken in selecting the patients who will benefit from this operation, but also an experienced pancreatic surgeon working in a high-volume centre is required for performing the procedure[1–4,6,32,33].

Median panceatectomy is reported to be associated with no mortality but with a high postoperative morbidity, particularly pancreatic fistulas[6]. In our experience the "clinical" pancreatic fistula rates after pancreaticoduodenectomy and left pancreatectomy are 10 and 20%, respectively[23,35–37]. Between January 1990 and December 2005 61 patients underwent middle segment pancreatectomy at our Institution. The incidence of pancreatic fistula - according to the ISGPF definition[22] - was 51%. It is remarkable that most patients had a Grade A fistula, which is a "biochemical" fistula without any clinical impact, while 13 patients (21%) developed a Grade B or C fistula which required prolonged in-hospital stay. In all patients the conservative management was successfull: no one underwent reoperation and in four cases intra-abdomnal collections were treated with ultrasounds guided drainage. The mortality rate was zero.

The risk of developing a pancreatic fistula must be taken into account in the preoperative decision making; we believe that this risk is acceptable when the procedure is performed in a high-volume centre and for patients with a long-life expectancy, such as young or middle aged people affected by benign or low-grade tumours.

The most important advantage of middle segment pancreatectomy is the good endocrine and exocrine long-term function[1–6,10]. Iacono et al.[1] in a series of 13 patients demonstrated that postoperative oral glucose tolerance, pancreolauryl and fecal fat excretion were normal in all cases. They studied six patients pre- and postoperatively with an OGTT, showing no significant differencies before and after surgery. Moreover, Sperti et al.[3] showed, in a review of the literature, no case of impaired endocrine function in 59 evaluable patients while exocrine function was reported to be normal in 56 out of 59.

Another advantage of this procedure is the possibility to preserve the spleen, avoiding the risk of postsplenectomy sepsis and hematologic disorders, which is low but exists in adults[38,39].

In conclusion, middle segment pancreatectomy is a safe and technically feasible surgical approach for removing pancreatic neck tumours in well selected patients; in experienced hands it is associated with no mortality but with high morbidity. Most of the complications do no require reoperation or prolonged in-hospital stay and can be successfully managed conservatively. Moreover, it allows the surgeon to preserve pancreatic parenchyma and consequently long term endocrine and exocrine function.

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