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Surgical Indications and Techniques to Treat the Pain in Chronic Pancreatitis

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Additional information is available at the end of the chapter

Abstract

Chronic pancreatitis (CP) is a progressive inflammatory process, of the pancreatic gland and leads to damage and decrease in glandular tissue. Clinically, the pain is the most outstanding and incapacitating sign (95% of patients), as well as exocrine pancreatic insufficiency. The two main objectives in CP treatment are pain relief and complication management. Pain is the main surgical treatment indication. Patients with pancreatic duct dilation require surgical drainage, which provides an important pain relief (70–80%). Decompression (drainage), resection and neuroablation are the most commonly used surgical treatment options of CP. Derivative surgical procedures as Puestow-Gillesby or its modification, Partington-Rochelle, are the best options if the Wirsung duct is dilated, and Izbiki procedure if it is not. Resection is the choice when there is an important affectation of the head of pancreas with repercussion in bile duct or duodenum, as well as those patients with suspicion of carcinoma or in those ones who cannot be ruled a malignant tumour. The resection surgical procedures are Whipple, Traverso-Longmire, Frey (resective-derivative) and Beger (resective-derivative). To conclude, surgeon must know not only every surgical procedure indications but also be familiarised with all of them. The surgical procedure must be individualised to the patient and the disease stage.

Keywords: chronic pancreatitis, pain, surgical management

1. Introduction

Chronic pancreatitis (CP) is a progressive inflammatory process, which affects pancreatic gland and leads to damage and decrease in glandular tissue [1]. Clinically, the pain is the most outstanding and incapacitating sign (95% of patients), as well as exocrine pancreatic

insufficiency. The most important pathologic finding in CP is the replacement of normal pancreatic tissue for irreversible fibrosis [2–6]. The CP incidence is between 2 and 200 per 100,000 persons and shows an increasing trend year by year. Historically, excess alcohol consumption plays the leading cause role in Western countries, accounting for 60% of CP cases, although tobacco consumption, usually joined to alcohol consumption, plays the most important role in pancreas cell injury [7].

On the basis of the histopathological changes in the pancreas, CP can be classified into three types: (1) chronic obstructive pancreatitis, (2) chronic calcifying pancreatitis (the most common type of CP, which includes alcoholic CP) and (3) chronic inflammatory pancreatitis, including CP resulting from chronic inflammation of the biliary tract and stenosis induced by scar formation [8, 9].

In principle, patients with CP need medical treatment for long periods of time or indefinitely, as long as the medical treatment relieves symptoms and patients do not develop any complication requiring surgery. Disabling pain, analgesic treatment refractory or cause opiate dependence, is the most frequent symptom sets the surgical indication. However, other well-established surgical prescriptions are the complications of adjacent organs such as bile duct or duodenum stenosis, associated pseudocysts with ductal anomalies, pancreatic fistulas, ascites, gastrointestinal bleeding from oesophageal varices secondary to segmental thrombosis of the splenic vein and portal hypertension or inability to differentiate whether a pancreatic mass is really a focal CP or a neoplasia [10–13].

Furthermore, several authors suggest the superiority of surgical therapy over endoscopic therapy for chronic pancreatitis and pancreatic duct obstruction. However, many papers have been published on the possibilities offered by interventional endoscopy nevertheless the endoscopic therapy only reach a rate of 32% in pain relief, the worse result than any surgery procedure [14–20].

The two main objectives in CP treatment are pain relief and complications management. An optimum treatment must provide social and occupational rehabilitation as well as no pain recurrence. The problem is that there is neither an exact or validated measure of pain control nor randomised clinical studies comparing surgery with conservative treatment to help establish the indication of surgery [10]. It is usually recommended to consider surgery when the patient needs major opioids for more than 3 months and in case of treatment side effects or lack of obvious benefit [21–24].

2. Indications of surgery

The most accepted surgical indications are as follows [23]:

1. Refractory abdominal pain

2. Local complications:

- Bile duct stricture causing cholestasis

- Severe duodenal stricture (<1 cm diameter)

- Persistent inflammatory mass in the head of the pancreas

- Pancreatic pseudocyst greater than 6 cm

- Pancreatic abscess

- Portal vein compression

- Gastric outflow obstruction

- Transverse colon stricture

- Pancreatico-enteric or pancreatico-pleural fistula

3. Pancreas divisum causing CP

4. Wirsung stricture with body and tail dilation

5. Suspicion of underlying malignant pancreatic lesion

Patients with pancreatic duct dilation require surgical drainage, which achieves pain relief in 70–80% of the cases [10]. Decompression (drainage), resection and neuroablation are the most commonly used surgical treatment options of CP [25–27]. If the pancreatic involvement involved the head or the tail of pancreas or if the Wirsung is dilated, a pancreatic resection of the head or the tail or a pancreatojejunostomy is required. Chronic inflammation in the head of pancreas leads to main bile duct stricture in 60%, to duodenal stricture in 36% and to portal hypertension in 17% of the patients. Surgical indication in this group of patients is evident; however, when the whole pancreas is damaged or the Wirsung duct is not dilated, the surgical indication is not so clear [28].

Derivative surgical procedures as the techniques described by Puestow, Gillesby or its modification, Partington-Rochelle, are the best options [29, 30]. The Wirsung duct should have enough diameters (6–8 mm) to perform a pancreatojejunal anastomosis. If the diameter is smaller, a longitudinal V resection of the anterior pancreas can be performed, followed by a pancreatojejunal anastomosis, as Izbiki published [31–34]. The main advantages of drainage procedures are their low morbidity and mortality rates, although up to 20–30% of the patients do not benefit of the surgical drainage and have persistent pain. We should select this group of patients and offer them a different treatment [31].

Resection is indicated when there is an important involvement of the pancreas head, a bile duct or duodenum obstruction and for those patients with suspicion of carcinoma or when a malignant tumour diagnosis cannot be discarded [35]. Resective surgical procedures are the techniques of Whipple, Traverso-Longmire, Frey (resective-derivative) and Beger (resective-derivative) [11–13, 26, 27, 35–37]. Beger and Frey procedures are both complex techniques with no differences in terms of pain relief and exocrine function preservation. The main drawback for these last techniques is the risk of tumour dissemination during surgery, as they are incomplete

resection procedures and the risk of an underlying carcinoma is around 10% of the patients. Literature reports show a great variation in morbidity and mortality for each technique.

The surgeon should know every surgical procedure and its indications and be also familiarised with all of them. The surgical procedure should also be individualised to the patient and his stage of disease.

3. Surgical techniques

3.1. Decompression techniques

Wirsung duct originates in the pancreatic tail and crosses the gland midway between its superior and inferior borders, slightly posterior. Around 15–20 secondary ducts joint it in a perpendicular way. Main duct diameter ranges between 3.1 and 4.8 mm in the head, decreasing progressively to 0.9–2.4 mm in the tail. Accessory Santorini duct usually drains the anterosuperior part of the head and ends either in the duodenum through the minor papilla or in the main duct [38, 39].

Between 40 and 60% of patients with symptomatic chronic pancreatitis present ductal dilation, i.e. a ductal diameter >5 mm. Duct dilation may be due to a single stenosis, multiple stenosis, intraductal litiasis or a combination of stenosis and litiasis. Assuming that ductal dilation implies ductal hypertension and indeed pain, ductal decompression is the main surgical goal for these cases of CP [39]. These procedures should be done when Wirsung diameter is greater than 7–8 mm, but always in the absence of an inflammatory mass [40].

The first techniques described by DuVal and Zollinger in 1954 entailed the resection of the pancreatic tail and the anastomosis to a Roux-en-Y bowel loop [41, 42]. Obviously, this procedure is useful in the few patients with a single stenosis between the tail and the ampulla and is rarely used nowadays. Puestow and Gillesby reported in 1958 a technique providing a wider drainage. To the splenectomy and the resection of the tail, they added a longitudinal opening of the main duct and a latero-lateral pancreatojejunostomy. This technique is neither frequently used [29].

Two years later, Partington and Rochelle reported a procedure involving the longitudinal opening of the Wirsung duct but avoiding the resection of the pancreatic gland and the splenectomy. This technique is the most used as of today. It entails the opening of the duct from the tail to the head, stopping at 1 cm from the duodenal wall, the removal of all the existing calculi and the anastomosis to a Roux-en-Y bowel loop [30]. Although there is no consensus on the minimum diameter of the duct to indicate the procedure, most of the surgeons choose this technique for a size of the duct, when it is 7 mm or more. The procedure achieves relief of pain in 65–80% of patients, with a low mortality (less than 3%) and an acceptable morbidity (less than 20%) [25].

3.2. Resection techniques

Between 30 and 50% of the patients with CP develop inflammatory and fibrotic pancreatic masses. Many researchers refer the pain of the CP to the neural entrapment of the fibrotic pancreatic tissue and to the damage of the neural Schwann sheath by inflammatory cells.

This process may be limited to some parts of the gland and go along with or without ductal dilation [43–46]. When the CP presents with an inflammatory mass without ductal dilation or when drainage procedures had failed, surgical treatment is based on resection. Metabolic effects must be taken into account when pancreatic parenchyma is resected [47].

Depending on the affected area, resective procedures are pancreatoduodenectomy, duode-num-preserving head pancreatectomy, distal pancreatectomy, central pancreatectomy and total pancreatectomy.

3.2.1. Duodenopancreatectomy

The pancreatic head is the part of the gland more frequently affected by ductal changes and inflammatory masses and the site where biliary and duodenal complications arise. Many authors consider the pancreatic head as the "pacemaker" of the disease and emphasise its resection as the most important part of the treatment [48–52].

Whipple performed the first pancreatoduodenectomy in 1935 and the first one for CP in 1946 [12, 53, 54]. This procedure is the more commonly used for masses in the pancreatic head. Its main disadvantage is the removal of healthy organs: stomach, duodenum and bile duct. This is why Traverso and Longmire designed a modification in 1978, preserving pylorus (pylorus preserving pancreatoduodenectomy or PPPD) and thus avoiding the loss of gastric digestion and absorption functions, thereby decreasing the risk of postoperative malnutrition [11–13, 32, 33, 43, 44, 53–60].

Pancreatoduodenectomy, with or without pyloric preservation, relieves pain in more than 80% of the patients [48–52]. Mortality is less than 5% in high volume centres, but morbidity is around 40%, more frequently due to exocrine (23–95%) than endocrine (10–40%) insuf-ficiency [50].

3.2.2. Duodenum-preserving head pancreatectomy

The procedure was described by Beger in the 1970s [13, 61]. Duodenum is of the outmost importance in the regulation of glycaemia and gastric emptying. This technique is considered a combined decompression-resection procedure. When a malignant neoplasm is ruled out, this is the procedure of choice, although it is also the most technically demanding. It includes the transection of the pancreatic neck above the portal vein, the resection of pancreatic head masses, the preservation of the posterior branch of the gastroduodenal artery to retain the blood supply of the duodenum and the preservation of the integrity of the lower end of the common bile duct to obtain a decompression effect in the common bile duct and duodenum. The proximal pancreatic duct is ligated and the distal end is used for pancreatojejunostomy. The same loop may be used for latero-lateral anastomoses to the proximal duct. Even in cases with biliary or duodenal stenosis due to entrapment by the tumour, this technique permits an adequate drainage without resecting bile duct or duodenum [61].

Pain is improved in 80–90% of the patients, with a low recurrence rate (8–11%) during follow up. Morbidity of this technique is between 15% and 55%. Mortality is exceedingly low (0.8%)

in Beger experience. This author reported that endocrine function kept unchanged in 82%, improved in 9% and worsened in 2% of the patients. Regarding exocrine function, around 65% of the patients needed some enzymatic supplements [55, 57, 58].

For those patients with a mass in the pancreatic head and ductal dilation, a combination of a latero-lateral pancreatojejunostomy with the enucleation of the pancreatic head was described by Frey in 1987. Like Beger's technique, it spares duodenum and bile duct but is technically less demanding since the posterior part of the head is preserved and the anastomosis is performed at the anterior aspect of the gland. This technique should not be used when there is a large mass in the head and no stenosis of the main duct [21, 22, 35–37, 57–59].

Recent reports comparing Frey's, Beger's and pancreatoduodenectomy resections (**Table 1**) showed that, if patients are correctly selected, any of the three techniques is able to improve symptoms in around 90% of the cases [32, 43, 45, 46, 58]. They were similarly useful in treating complications on neighbouring organs, bile duct and duodenum. The former two procedures resulted in better quality of life and earlier postoperative recovery and had a mortality rate lower than 3% in skilled hands. Morbidity was somewhat less frequent in Frey's than in Beger's technique, and in both two was quite lower than in pancreatoduodenectomy. Endocrine and exocrine activities are similarly affected by the all three.

Authors	Procedure	N	Surgical mortality (%)	Morbidity	Fistula (%)	Pain relief (%)
Koninger et al.	Beger/Frey	32/33	0/0	20/21	7/3	–/–
Buchler et al.	Beger/DP	20/20	0/0	15/20	0/5	94/77
Farkas et al.	Beger/DP	20/20	0/0	0/40	–/–	100/100
Izbicki et al.	Frey/DP	31/30	3/0	19/53	3/7	80/75
Izbicki et al	Beger/Frey	20/22	0/0	20/9	5/0	70/70
Klempa et al.	Beger/DP	22/21	1/0	54/51	0/5	100/70

Beger, Beger procedure; Frey, Frey procedure; DP, duodenopancreatectomy; *N*, number of patients included.

Table 1. Randomised control trials among different surgical techniques in abdominal pain relief (follow up, 1–4 years).

These techniques have been compared in several reports. A retrospective randomised controlled trial showed that the recurrence rate after Frey procedure (19%) was lower than that after Traverso-Longmire (53%). Another report showed lower recurrence rate for Frey procedure (22%) than for Beger's (32%). Endocrine insufficiency rate after 7 years was reported to be better for Frey procedure (86%) than for PPPD (96%), as well as after 8 years for Frey procedure (78%) compared with Beger procedure (88%).

Others techniques include Berne's modification, which preserves the neck of the gland and shows better results and less morbidity than PPPD and Beger's technique [55, 62]. Its goal is to avoid dissection in the portal region, sometimes affected by the inflammatory process. The

recurrence rate is 20–23%. Izbicki modification of the Frey procedure, reported in 1998, consists in a wide V-shaped resection of the head and uncinate process. It is indicated in CP with a duct smaller than 3 mm. Imizumi modification of the Beger's technique is useful in patients with intrapancreatic biliary stenosis, achieving a relief of pain in 90% of the patients with little metabolic changes [61, 63].

3.2.3. Distal pancreatectomy

When CP affects mostly to the left part of the gland and the head is normal, the treatment is a distal pancreatectomy. Trendelenburg performed the first distal pancreatectomy for the treatment of a neoplasm in 1882. This procedure is indicated when there is a break in the duct or a suspicious humoral mass and the duct diameter is less than 5 mm [64, 65].

Two important technical issues regarding this surgical technique are spleen preservation and pancreatic remnant management. Spleen must be spared whenever possible, but not in cases of splenic thrombosis or of pancreatic pseudocyst adherent to the spleen or splenic hilum. Regarding the pancreatic remnant, a suture of the duct and the parenchyma can be done or, alternatively, it may be sutured to a Roux-en-Y loop after DuVal technique. In both instances, the main duct should be explored to rule out stenosis or litiasis.

The mortality of the procedure is around 5% and the morbidity is 20%. From 0 to 7% of the patients develop a pancreatic fistula [42, 66]. The greater drawback of this surgery is a failure rate of 17–74% (media 36%) in relieving symptoms, mainly pain, although these results may be due to a deficient selection of patients. On the other hand, metabolic derangement greatly depends on the amount of the resected glandular tissue, but malabsorption needing treatment appears in 25–30% and diabetes in 17–85% of the patients [64, 65].

3.2.4. Central resection

In a few patients, inflammatory changes sit at the pancreatic neck or slightly to its left. Sometimes, there is a sole ductal stenosis or a ductal litiasis between head and body of the pancreas. In these rare cases, neither deemed to drainage nor to head or distal resection, central resection with suture of both distal ends of the duct to a jejunal loop is the technique of choice.

Central resection shows notable success in dealing with pain and has low mortality and morbidity rates and mild deleterious effect on pancreatic functions [10, 59, 67–70] .

3.2.5. Total pancreatectomy

Priestley is credited with the first total pancreatectomy to treat a patient with hyperinsulinemia [47]. Around 20% of the patients treated with surgery for CP show unsatisfactory outcomes, although it is difficult to determine whether they are due to the natural progression of the disease or to surgical failure. It is also intricate to elucidate what amount of analgesic use is due to drug dependence and what to real pain. Moreover, the recurrence of the symptoms may be caused by a superimposed disease. Finally, a relapse in alcohol intake may further complicate this complex matter.

Total pancreatectomy is not necessarily the next step of the treatment for the reappearance of the symptoms. After a failed drainage technique, improving draining capacity through widening the pancreatojejunal anastomoses or partially resecting the pancreatic head may be adequate. If the new changes appear in the pancreatic tail, a distal pancreatectomy may be the solution.

The results after total pancreatectomy are not very fair, mainly because of endocrine and exocrine morbidity. Nevertheless, it is indicated for patients with failed surgical procedures who already present endocrine and exocrine insufficiency, for patients with diffuse CP with multiple litiasis in small ducts and gland insufficiency and, probably the most controversial indication, for patients with diffuse disease without changes of the duct who present with repeated bouts of pancreatitis and are unresponsive to conservative treatment [65, 71, 72].

After surgery, symptoms improve in 50% of the patients; mortality is 5–10% and morbidity is around 40%. The most serious complications are metabolic, hypoglycaemic shock above all [73].

4. Summary

There are several surgical techniques to treat CP, recommended when medical treatment is ineffective or appear complications that can be surgically corrected. Success of these treatments depends on the natural history of the disease, on the appropriate selection of the technique and on the objectives and expected results. Surgeons must be aware of their surgical expertise and of the rate of pain control, morbi-mortality, quality of life and functional changes of the chosen technique.

Recommendations	Evidence level	Recommendation grade
Surgery is effective in the treatment of pancreatic pain	1b	A
When there is a pseudocyst in patients with abdominal pain, it is recommended that therapeutic interventions include treatment of pseudocyst	3b	B
In patients with ductal dilatation and pain, surgery offers better results than endoscopic treatment	1a	A

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