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Surgical Treatment of Pain in Chronic Pancreatitis

Indications, Optimal Timing and Technical Approaches

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Introduction

Chronic pancreatitis (CP) is characterized by recurrent inflammatory episodes of the pancreas, resulting in fibrotic replacement of pancreatic parenchyma and leading to progressive loss of pancreatic exocrine and/or endocrine function [1]. CP is associated with the development of local and regional complications, including pseudocysts, obstruction of the pancreatic and bile ducts, duodenal obstruction, and vascular complications. It can result in pain (acute and chronic), malnutrition, poor mental health, and the potential for malignant transformation within the pancreas [1]. These multisystem issues have significant impact on quality of life (QOL) [2]. The mainstays of treatment for CP are pain control and management of pancreatic endocrine and exocrine insufficiency. In addition, 30–60% of patients develop complications that require intervention, which must be taken into consideration when considering surgery for pain [1]. There is considerable debate over the relative roles of endoscopic and surgical intervention to treat pain in chronic pancreatitis [3,4], recognizing that a multidisciplinary approach is required to ensure interventions are tailored to each individual [5]. Chronic pain is experienced by approximately 85% of patients with CP, and it is the main indication for surgery in this condition [6]. Accordingly, nearly half of all patients with CP receive surgery to treat chronic pain [7,8]. One of the problems in this field is that the current tools for the assessment of pain severity and characteristics in patients with CP are limited [9].

Indications and Contraindications for Surgical Treatment

In general terms, the factors that favor surgery as the means to control pain in CP are longer life expectancy of the

patient, lower comorbidity load, lower expected operative morbidity, and the importance of selecting a durable single therapeutic intervention [1]. Conversely, factors that favor nonsurgical interventions to control pain in CP are shorter life expectancy of the patient, higher comorbidity load, decreased technical feasibility of surgery (e.g. presence of portal hypertension and associated intra-abdominal varices), and higher expected operative morbidity.

The most frequent indication for surgical treatment of patients with CP is pain. While there are multiple mechanisms for pain in CP and different treatment modalities, there are two frequent clinical settings for which surgery has evolved to address [10,11]. The first is obstructive pancreatopathy, where stones and/or strictures result in ductal obstruction with hypertension and dilation. These patients often have an exacerbation of pain after eating and tend to benefit from decompression. The second is an inflammatory mass, usually in the head of the pancreas, and usually associated with an exacerbation of constant pain. In this setting, an underlying pancreatic cancer needs to be considered and these patients tend to benefit from resection. It is noted that the risk of malignant transformation is negated by total pancreatectomy. Other indications for surgical treatment include gastric, duodenal, and biliary obstruction secondary to a fibrotic stricture and/or mass effect (e.g. from a pseudocyst). Addressing these complications can be done at the time of surgery with concomitant cysto-jejunostomy, gastro-jejunostomy and choledochojejunostomy, respectively. Failed endoscopic treatments (including shock-wave lithotripsy, dilation and stenting) are not an indication or a contraindication for surgical treatment per se. The concern is that surgical relief of pain can be delayed by multiple attempts at endoscopic treatment, and surgical treatment should not be considered “last resort” treatment. Achieving pain relief with trial endoscopic stent decompression of the pancreatic duct has

been considered by many to be a relative indication for surgical decompression [12]. Isolated pancreatic exocrine or endocrine insufficiency, in the absence of any other symptoms or complications, is not an indication for surgery, as these can be managed with enzyme replacement therapy and insulin [13].

There are contraindications for surgical treatment, in addition to patient comorbidity and limited physiological reserve. Surgical treatment of CP can be offered in selected patients with portal hypertension secondary to portal/superior mesenteric vein thrombosis, but great caution is advised [14,15]. Central sensitization reduces the success rate of any treatment for pain relief but should not be used as an absolute contraindication to surgical treatment [16]. Surgical treatment is more successful if offered before this occurs. Continuing alcohol abuse has been considered an absolute contraindication to surgical treatment, but the ethics of this are questionable, especially as there is some evidence of benefit, even in this setting.

Diagnostic Work-up

Patients have often experienced months or years of symptoms before receiving a diagnosis of CP, and this can have a toll on their physical, psychological, and nutritional state [17–19]. CP may also be associated with other comorbidities that require intervention, and the etiology of each individual's CP diagnosis may need specific management. Therefore, before planning surgery, it is critical to conduct a thorough medical history, physical examination, and appropriate investigations. Substance abuse, in particular alcohol, must be identified and should trigger referral to appropriate drug and alcohol addiction services. The history should include a comprehensive assessment of the pattern of pain [9,20]. This will aid in identifying appropriate interventions and determine whether these interventions have been successful. Endocrine and exocrine function of the pancreas should be quantified [1]. Laboratory tests should include routine parameters in addition to markers of cholestasis, tumor markers, and nutrition. Since 25–30% of patients with CP are underweight and an even higher percentage have specific nutrient deficiencies (e.g. fat-soluble vitamins), nutritional compromise should be addressed when considering surgery for pain [17–19].

Imaging plays an important role in planning surgery for CP. This includes imaging to identify ductal and vascular anatomy, as well as local or regional complications that may impact on surgery. Ultrasound is able to detect parenchymal and ductal calcifications in the pancreas, although there is no correlation between the extent of calcification and severity of pain syndrome or pancreatic function [21]. Care must be taken to fully investigate any potential masses

in the setting of CP, and this will often require image-guided biopsy, preferably by endoscopic ultrasound (EUS), to rule out malignancy [1,22]. Cross-sectional imaging is the gold standard for assessment of the pancreas, with computed tomography (CT) and magnetic resonance imaging (MRI) providing complementary information to allow accurate determination of morphological changes in and around the pancreas [23]. CT pancreatic protocol provides detail on the vasculature around the pancreas and has good resolution for identifying any masses [24]. It is also sensitive for identifying calcifications within the pancreas. MRI is better able to demonstrate the main and secondary pancreatic ducts [23]. Secretin-stimulated MRI promotes dilation of the pancreatic duct, allowing finer detail of ductal pathology, such as strictures, to be seen. It is also useful for identifying an obstructive pancreatopathy, when there is a correlation between duct dilatation and an increase in pain [25]. ¹⁸F-fluorodeoxyglucose (FDG) positron emission tomography (PET) may help in differentiating pancreatic cancer from mass-forming CP, although this remains uncertain [26,27]. Pancreatic ductal findings, including diameter, presence of stones or strictures, and presence of an inflammatory mass, will ultimately guide whether a drainage, resection, or combined procedure should be undertaken.

Multidisciplinary input is required for all patients being considered for surgical intervention [28]. This includes input from gastroenterology, radiology, pain medicine, behavioral health, and nutrition specialists with an interest in CP. Key questions to consider before embarking on surgical interventions for pain in CP include the likely pain mechanism involved and whether surgery is appropriate for that mechanism.

Optimal Timing

Timing of surgery in CP has been examined in both observational studies and a clinical trial. Observational studies demonstrate better pain control and pancreatic function among patients who undergo early surgery (less than three years from diagnosis) [29]. Predictors of significant pain relief after surgery are duration of pain for three years or less, no preoperative opioid use, and five or fewer endoscopic treatments [30]. Early results from the ESCAPE trial indicated that early surgery for patients with painful obstructive CP provides better pain control with less interventions than the current step-up approach including endoscopy, but QOL is comparable [31]. Other studies have shown that early surgery is associated with better pain control and prolonged endocrine and exocrine function of the pancreas [29,32]. These findings have been confirmed in a meta-analysis that demonstrated an

increased likelihood of complete postoperative pain relief after early surgery (relative risk 1.67) and reduced risk of pancreatic insufficiency [33]. Overall, evidence favors surgical intervention before a requirement for daily opiate use and/or the onset of insulin dependence [8,34]. The limited number of clinical trials comparing surgical and endoscopic intervention for painful CP have clearly favored surgery in both short- and long-term outcomes [3,35–38]. Despite that and in practice, endoscopic interventions are often selected first due to patient and physician choice, perhaps because it is less invasive. Further trials in accurately selected subgroups are now required [3,4].

Clinical Considerations in Selecting the Surgical Approach

Surgical treatment for CP must be tailored to the individual and their specific symptoms or complications. There are a number of objectives and surgical treatment may combine more than one:

- decompression to relieve pancreatic ductal and/or parenchymal hypertension;
- removal of ductal stones;
- resection of an inflammatory mass;
- resection to prevent malignant transformation;
- resection for malignancy;
- resection for chronic pancreatic fistula or disconnected duct;
- drainage of a pseudocyst to relieve its mass effect on adjacent structures;
- drainage of an obstructed or stenosed bile duct;
- drainage of duodenal stenosis or obstruction;
- disruption of pain pathways.

The procedure selected should address the key objectives for each patient, while minimizing morbidity and maximizing long-term QOL. Specific questions that surgeons must consider before selecting the procedure include the following.

- While pain is often multifactorial, is there evidence that pain is due to ductal hypertension or active inflammation? Is there evidence of central sensitization and chronic pain syndrome?
- Are the drivers of pain due to pathology in the pancreatic head, body/tail, or throughout the pancreas?
- Is the pancreatic head enlarged (≥ 4 cm)? In the ESCAPE trial, patients with an enlarged pancreatic head were randomized to undergo a Frey procedure, while those with a nonenlarged pancreatic head had a longitudinal pancreaticojejunostomy [31].

- Is the pancreatic duct dilated (at least 5 mm), making a pancreaticojejunal anastomosis lower risk [39]?
- Are there local or remote complications that need to be managed, either before or at the time of the surgical treatment?
- Could the mass, if present, be malignant? Does the individual have a variant of CP that is higher risk for malignant transformation (e.g. hereditary pancreatitis)? Does the patient smoke, which increases the risk of malignant transformation?
- Does the individual already have insulin-dependent diabetes, making parenchymal preservation potentially less important?
- Does the individual have comorbidities that will affect their short- or medium-term life expectancy?
- Does the individual have current alcohol or recreational drug dependence that may affect their ability to manage their ongoing healthcare?
- Are local vascular complications present (e.g. venous thrombosis, stenosis or occlusion; arterial thrombosis or pseudoaneurysm)? Could these vascular complications limit the options for surgical intervention, or increase the risk of specific procedures?

Technical Approaches

Surgical treatments for CP are typically categorized as drainage, resection, or combined drainage and resection. In addition, there are other procedures that specifically disrupt pain pathways but which do not involve pancreatic surgery. The range of surgical procedures is illustrated in Figure 39.1 and the outcomes are summarized in Table 39.1.

Drainage Procedures

Longitudinal Pancreaticojejunostomy (Partington–Rochelle or Puestow)

The Puestow procedure was first described in 1958 [74]. This featured an invaginating caudal pancreaticojejunostomy after incising the body and tail of the pancreas longitudinally, with the jejunum brought to the pancreas from the left side. This was subsequently modified by Partington and Rochelle as a side-to-side Roux-en-Y pancreaticojejunostomy, with the Roux limb brought to the pancreas from the right side [75]. The Partington–Rochelle modification is also incorrectly referred to as the Puestow procedure. The procedure is able to decompress the pancreatic duct throughout the body and tail of the pancreas but does not deal with disease in the head and uncinate process of the pancreas. It is most appropriate for patients with a dilated pancreatic duct.

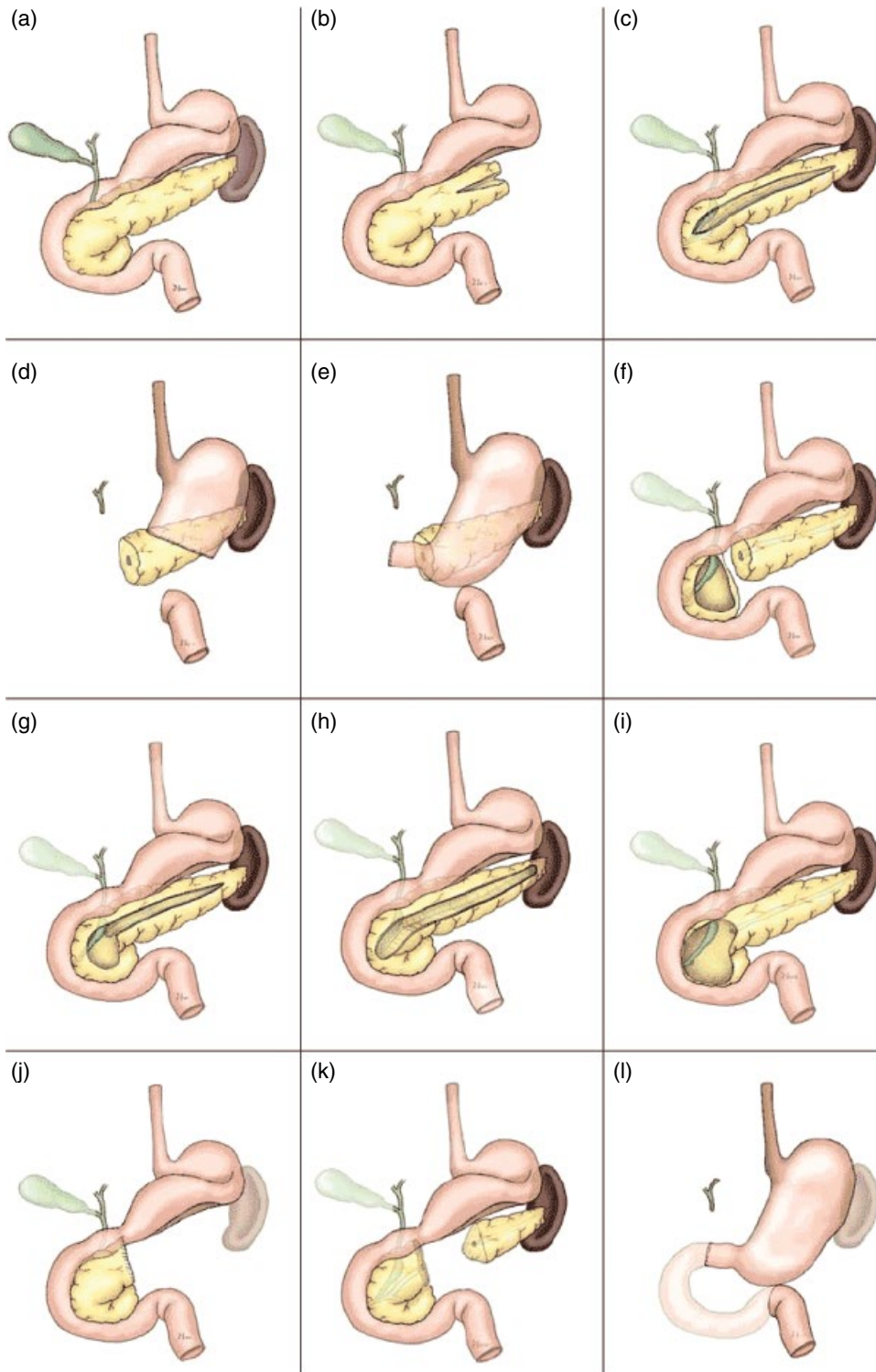


Figure 39.1 Diagrammatic representation of surgical operations for chronic pancreatitis: (a) normal pancreas; (b) extent of resection in lateral pancreaticojejunostomy according to Puestow; (c) longitudinal pancreaticojejunostomy according to Partington–Rochelle; (d) partial pancreatectomy (classic) according to Whipple; (e) partial pancreatectomy (pylorus preserving); (f) duodenal-preserving pancreatic head resection (DPHHR) according to Beger; (g) DPHHR according to Frey; (h) V-shaped excision according to Izbicki; (i) DPHHR according to Berne; (j) distal pancreatic resection; (k) segmental or central pancreatic resection; (l) total pancreatectomy. *Source:* Kleef et al. [79]. Reproduced with permission of Deutscher Ärzte-Verlag.

Table 39.1 Surgical interventions for pain in chronic pancreatitis.

| Procedure | Indication | Morbidity | Mortality | Pain relief | Endocrine insufficiency | Exocrine insufficiency |
|--|---|----------------------|----------------------|-----------------------------|-------------------------|-------------------------|
| Drainage | | | | | | |
| Longitudinal pancreaticojejunostomy (Puestow) | Dilated pancreatic duct (≥ 5 mm); absence of head of pancreas mass | 6–19% [40–43] | 0–4.2% [40–43] | 70–80% at 5–10 years [8,44] | 11–25% [42] | |
| Combined drainage and resection | | | | | | |
| Duodenum-preserving pancreatic head resection with end-to-end pancreaticojejunostomy (Beger) | Head of pancreas inflammatory mass (>4 cm) with dilated pancreatic duct (≥ 5 mm) | 19–32% [45–47] | $<1\%$ [45–47] | 80% at 7–15 years [48] | 10–26% [45,46,49,50] | 10–34% [45,46,49,50] |
| Berne modification of the duodenum-preserving pancreatic head resection with end-to-end pancreaticojejunostomy | Head of pancreas inflammatory mass (>4 cm) with nondilated pancreatic duct (<5 mm) | 16% [51] | 1% [51] | 55% [51] | | |
| Local resection of the pancreatic head with longitudinal pancreaticojejunostomy (Frey) | Head of pancreas inflammatory mass (>4 cm) with dilated pancreatic duct (≥ 5 mm) | 15–22% [45–47,52–55] | $<1\%$ [45–47,52–55] | 75–95% [45–47,52–55] | 6–20% [45–47,52–55] | 11% [45–47,52–55] |
| Resection | | | | | | |
| Pancreaticoduodenectomy (Whipple) | Head of pancreas mass confirmed or suspicious for malignancy; inflammatory head of pancreas mass with associated duodenal obstruction | 16–53% [56–61] | 0–3% [56–61] | 34–100% [46,56–61] | 12–48% [56–61] | 25–51% [56–61] |
| Distal pancreatectomy (with or without spleen preservation) | Isolated body/tail or pancreas stricture associated with distal gland atrophy; mass in distal pancreas confirmed or suspicious for malignancy | 15–35% [50,56,62,63] | 0–5% [50,56,62,63] | 55–81% [50,56,62,63] | 38–69% [40,50,56,62–64] | 29–47% [40,50,56,62–64] |

(Continued)

Table 39.1 (Continued)

| Procedure | Indication | Morbidity | Mortality | Pain relief | Endocrine insufficiency | Exocrine insufficiency |
|--|---|----------------|--------------|-----------------|-------------------------|------------------------|
| Total pancreatectomy (with or without spleen preservation) | Head of pancreas inflammatory mass (>4 cm) with atrophic distal pancreas and type 3c diabetes mellitus; diffuse small duct chronic pancreatitis and type 3c diabetes mellitus | 40–50% [65–67] | 0–6% [65–67] | 82–100% [65–67] | 100% | 100% |
| Total pancreatectomy with islet autotransplantation | Hereditary chronic pancreatitis without evidence of malignant transformation or diabetes | 40–50% [65–69] | 2–8% [65–69] | 82–100% [65,70] | 20–100% [71–73] | 100% |

Combined Drainage and Resection Procedures

Duodenum-preserving Pancreatic Head Resection with End-to-end Pancreaticojejunostomy (Beger)

Following careful analysis of the vascular supply of the pancreas in animal models, Beger performed the first duodenum-preserving pancreatic head resection in 1972, although he did not publish his results until 1980, by which time he had performed 52 such procedures [76]. In this procedure, the neck of the pancreas is divided, and the parenchyma of the pancreatic head resected except for a small rim along the medial aspect of the duodenum. The common bile duct is either preserved or decompressed as a choledochopancreatostomy. The duct within the distal pancreas is probed and opened longitudinally in the presence of strictures or stone obstruction. Reconstruction is conducted with a pancreaticojejunostomy to the remnant distal pancreas, and an end-to-side pancreaticojejunostomy to the remnant head and duodenum. There is evidence to show that pain relief can be achieved in 80–85% of patients at five years [77].

Berne Modification of the Duodenum-preserving Pancreatic Head Resection with End-to-end Pancreaticojejunostomy

First described by Gloor in 2001, this variant did not require transection of the pancreatic neck and allowed a single pancreaticojejunal anastomosis to be performed [78]. There is evidence that this is as effective as the Beger procedure in achieving pain relief but associated with less blood loss [79].

Local Resection of the Pancreatic Head with Longitudinal Pancreaticojejunostomy (Frey)

This procedure was first described in 1987 by Frey and Smith, and involved “coring out” of the pancreatic head with preservation of a rim of pancreas around the entire head and uncinate process [80]. The distal duct is opened longitudinally, in continuity with the cored-out head. The pancreatic neck is left intact. It is important to avoid breaching the posterior fibrotic “capsule” of the pancreas. To achieve this, the posterior limit of resection should be the back wall of the opened pancreatic duct [52]. It is worth opening the duct to the uncinate process and the accessory duct to ensure drainage of the uncinate and dorsal pancreatic head. A side-to-side Roux-en-Y pancreaticojejunostomy is then fashioned for the reconstruction. If required, decompression of the bile duct may be performed either as a choledochopancreatostomy into the excavated head, or as a separate choledochojejunostomy on the same Roux limb. Frey later described a further modification of his procedure, which avoided opening the pancreatic duct longitudinally in the pancreatic body and tail, in the absence of stones and strictures, thus relying primarily on excavation of the head only [81].

The “Hamburg” Modification to the Frey Procedure

The “Hamburg” modification to the Frey procedure was described by Izbicki (usually called the Izbicki procedure), and incorporated a wider excision of the pancreatic head and a triangular wedge of the ventral surface of the pancreas along the length of the pancreatic duct [82]. This method was developed for small-duct disease and limited evidence suggests that it might have comparable rates of pain control.

Resection Procedures

Pancreaticoduodenectomy (Whipple)

Resection procedures for CP predominantly focus on the pancreatic head, as this is the location where most compressive complications occur [1]. Pancreaticoduodenectomy was first described by Whipple in 1935 and has been used to control pain in CP since at least the 1970s [49]. However, uptake of the procedure for CP was initially slow due to the high perioperative mortality rate of up to 30% [83]. In the last two decades, pancreatic surgery has become more standardized, both in technique and in perioperative management, resulting in mortality rates of less than 5% for pancreaticoduodenectomy in high-volume centers, and results in sustained relief of pain in 70–90% of patients [57,84]. Modifications to the procedure have been introduced over time, including pylorus preservation [85] and variations in the pancreato-enteric anastomosis [86,87].

Distal Pancreatectomy (with or without Spleen Preservation)

The indications for a distal pancreatectomy are segmental inflammatory changes in the neck or body of the pancreas, resulting in chronic left-sided pancreatic changes [88]. It is sometimes appropriate management for disconnected duct syndrome. For this to provide significant and long-lasting relief of pain, the remnant pancreas must be essentially normal, without any signs of inflammation. The procedure may be undertaken with an open, laparoscopic, or robotic approach [89,90]. Overall, the results of distal pancreatectomy result in long-term pain relief in 60% of patients, with the operation likely failing because it leaves a major part of the pancreas untreated and which may go on to become symptomatic.

Total Pancreatectomy (with or without Spleen Preservation)

The first successful total pancreatectomy was reported in 1944 by Priestly [91]. The procedure results in pancreatic pan-endocrine and exocrine insufficiency (type 3c diabetes) [92]. Until recently, type 3c diabetes was a major source of morbidity and mortality after total pancreatectomy, such that half of all late deaths after the procedure were due to iatrogenic hypoglycemia [93]. In recent years, a better

understanding of the condition has allowed astute management of both pancreatic endocrine and exocrine replacement therapy, such that mortality is rarely due to these consequences [92].

Total Pancreatectomy with Islet Autotransplantation

This procedure incorporates total pancreatectomy with the islet cells harvested for reimplantation into the liver via the portal venous circulation. The procedure is mostly considered in patients with mild disease associated with hereditary pancreatitis. It has also been proposed for patients with established diffuse CP with nondilated duct and disabling pain, unresponsive to other treatment modalities [94].

Denervation Procedures

Celiac Plexus Block

This procedure is best performed by EUS [95]. However, it may be undertaken during pancreatic surgery [96]. To achieve this, local anesthetic (e.g. 1% xylocaine 20 ml) combined with 20 ml 95% ethanol is injected into the para-aortic soft tissue on either side of the celiac trunk. Celiac plexus block is only effective for weeks to months and is an inferior long-term pain management strategy [97]. Although it can be repeated, progressive scarring of the injected tissues means that it becomes decreasingly effective. It should be reserved for patients with a poor expected survival, in whom more definitive interventions cannot be considered [1].

Sympathectomy

Abdominal sympathectomy for CP-related pain was first described in 1949 by Ray [98]. This approach evolved to include thoracoscopic splanchnicectomy [99]. Here the splanchnic branches (greater, lesser, least) of the sympathetic nerve are divided on the posterolateral thoracic wall, on one side or both. While short-term results showed significant reduction in pain, medium- and long-term follow-up have been disappointing, such that the majority of patients return to baseline pain scores and opiate usage after 12 months [100].

Tips and Tricks for Surgical Interventions

1) Trial of stenting may be used to determine whether duct decompression alleviates any postprandial pain. If so, then decompressive surgery may be more likely to provide symptomatic benefit.

- 2) A stent may be placed preoperatively to facilitate identification of the pancreatic duct, allowing earlier intervention when the duct is only mildly dilated but the patient has symptoms consistent with a hypertensive duct or gland.
- 3) If surgical intervention is being used for biliary obstruction, preoperative biliary stenting should be avoided unless surgery is not able to occur in a timely manner, or if cholangitis is present. Biliary stenting is associated with higher rates of postoperative infections [101].
- 4) Patients with an inflammatory mass in the head of pancreas, resulting in obstruction of the pancreatic duct, rarely experience improvement in pain from a drainage procedure alone and should be considered for a duodenum-preserving pancreatic resection procedure [102].
- 5) Compression of the portal vein by inflammation in the head and neck of the pancreas may be treated with a procedure that divides the neck of the pancreas [103]. In practical terms, the Beger procedure has lower morbidity than a pancreaticoduodenectomy in this setting and is preferred.
- 6) Involve pain specialists during operative planning, as most patients having surgery for pain are not opiate-naïve, and their postoperative pain management is complex. The patient must understand that pain control may be temporarily worse after surgery or may be affected by the changes in gastrointestinal function.
- 7) Recurrent pain that develops in patients who had a good pain response to surgery may be considered for repeat surgery if there is a clear indication for it (e.g. inflammation of the uncinate process or tail if not adequately decompressed). However, persistent pain after surgery is less likely amenable to further surgical intervention, in the absence of a correctable complication [104].

Outcomes and Quality of Life after Surgery

Pain is the main outcome used to measure the impact of surgery for CP. A European cohort study found that 68% of patients who underwent surgery for CP had complete or near-complete resolution of pain after a median follow-up of 63 months [8]. Risk factors for ongoing pain were preoperative daily opiate use and high number of preoperative endoscopic interventions [30]. QOL in CP has been assessed with a range of instruments, including the Medical Outcomes Short Form Health Survey (SF-12 and SF-36), Pancreatitis Quality of Life Instrument (PANQOLI), and the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QOL Q30) [2]. Pancreatic function tests after surgery for CP demonstrate increased preservation of function after the

Frey procedure compared with pancreaticoduodenectomy [105]. Long-term data demonstrate no difference in pancreatic endocrine and exocrine function between patients who undergo the various forms of duodenum-preserving pancreatic resection [106,107].

Clinical trials have been conducted to compare the endoscopic and surgical treatment of pain, demonstrating improved control after surgery (32–65% vs. 75–86%) [37,108]. In addition, surgery offers a more durable solution to pain control compared with endoscopic therapy, with stents requiring replacement every 3–12 months. The different surgical treatments for CP have been compared in clinical trials [109–112], and further subjected to meta-analysis [107]. Many of these have demonstrated equivalent short- and long-term outcomes for pancreaticoduodenectomy and duodenum-preserving resection procedures (e.g. Beger, Berne, Frey). Meta-analysis demonstrated improved QOL and better postoperative pain relief following Beger duodenum-preserving pancreatic resection compared with pancreaticoduodenectomy [48,113]. In addition, due to the potential for shorter operative time and hospital length of stay with the duodenum-preserving procedure, these are now favored. A comparison of the various duodenum-preserving procedures has not found an advantage for any single intervention, and therefore it seems appropriate for surgeons to select the procedure based on their experience and training. For patients who undergo total pancreatectomy with islet autotransplantation, insulin independence decreases over time, reaching as low as 30% at one year and 10% at eight years [94,114]. Likewise, meta-analysis has demonstrated an opiate-free rate of 63% at one year after surgery [114]. Despite these findings, QOL improves after total pancreatectomy with islet transplantation.

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There is some evidence that pancreatic surgery should be concentrated in centers with higher volume experience. Current guidelines suggest that more than 11 pancreatic resections per year should be set as the threshold for defining a high-volume pancreatic center [28]. However, this metric has not been validated in the setting of surgery for CP. It should also be noted that experience and training in diagnosis and management of CP in a multidisciplinary setting is advised for centers performing surgical interventions for CP. Higher-volume centers are more likely to establish and follow standardized patient care pathways, which have been shown to decrease morbidity and improve efficiency [115].

Follow-up

Patients who have had surgery for pain in CP should have ongoing follow-up to screen for complications (e.g. biliary obstruction), monitor CP-related sequelae (e.g. pancreatic endocrine and exocrine insufficiency), and perform surveillance for malignant transformation in high-risk individuals. Once patients have recovered from surgery, follow-up is recommended at every 6–12 months [1].

Conclusion

Surgical treatment of pain in CP has an important role to play and is complementary to endoscopic treatment. Selecting the right patient, offering treatment before the development of central sensitization and narcotic dependence, and choosing the most appropriate operation are all critical to achieving optimal results.

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