

Pancreas

Shailesh Shrikhande and Markus Buchler

<https://doi.org/10.1093/med/9780192858443.001.0001>

Published: 01 September 2022

Online ISBN: 9780191949241

Print ISBN: 9780192858443

Search in this book

CHAPTER

6 Surgery for Chronic Pancreatitis C6

Shailesh V. Shrikhande (ed.), Markus W. Büchler (ed.), Samiran Nundy (ed.), Dirk J. Gouma (ed.), Norbert Hüser, Volker Aßfalg, Daniel Hartmann, Güralp Ceyhan, Helmut Friess

<https://doi.org/10.1093/med/9780192858443.003.0006> Pages 45–54

Published: September 2022

Abstract

Surgical strategies for chronic pancreatitis include drainage of the pancreatic duct, resection of the pancreatic head affected by inflammation, or a combination of both. These approaches aim at the elimination of pain and relief of pancreatitis-associated complications of the adjacent organs, e.g. obstruction of the biliary duct, duodenum, or portal vein. Successful outcomes yield a better quality of life for these patients. However, current data cannot clearly delineate a superior surgical method or evidence-based recommendations for the underlying aetiology of the disease or the apparent symptoms. Duodenum-preserving and partial pancreatic head resections are at least as effective and safe as the classical surgical techniques (Kausch–Whipple and pylorus-preserving Whipple) with regard to low morbidity and mortality, pain control, preservation of endocrine and exocrine function, and adequate quality of life, respectively. In long-term follow-up, operative approaches are superior to endoscopic interventions.

Keywords: [chronic pancreatitis](#), [surgical treatment](#), [duodenum-preserving resection](#), [classic Kausch–Whipple procedure](#), [pylorus-preserving Whipple procedure](#), [drainage operation](#), [pseudocyst](#), [long-term outcome](#)

Subject: [Surgery](#)

Collection: [Oxford Medicine Online](#)

Introduction

C6.S1

Surgical treatment for chronic pancreatitis is symptom-oriented. Above all, the procedure focuses on pancreas-specific complications involving its adjacent organs and on improvement of pain and quality of life for the patients. The indications for surgical resection are whenever the patient suffers from symptomatic, intractable pseudocysts, compression of the portal vein, obstruction of the duodenum or bile duct, persistent pain despite conservative therapy, and suspicion of a malignant process. Both the extent and variation of (1) the clinical appearance, (2) underlying genetic, autoimmune, toxic, or obstructive disease-causing chronic pancreatitis with its different incidence rates across Western and Eastern ethnicities, and (3) patients' overall physical condition have an impact on surgical decision-making—either operative drainage of the pancreatic duct or resection of the inflamed and functionally impaired pancreatic head, or a combination of both. Different procedures for drainage and resection are well established for effective and sustainable therapeutic success, together with low morbidity and mortality rates.

C6.P1

Surgical principles in the treatment of chronic pancreatitis

C6.S2

Stepwise algorithm of treatment

C6.S3

A curative therapy for chronic pancreatitis does not exist. Usually, interdisciplinary cooperation results in a stepwise therapeutic escalation during long-term medical maintenance of affected patients. Initially, therapy for diabetes and administration of pancreatic enzymes are used to alleviate endocrine and exocrine pancreatic insufficiency. The World Health Organization scheme for chronic pain guides adequate analgesia using a combination of peripherally effective analgesics and tricyclic antidepressants and anticonvulsive agents (the so-called adjuvants), or first-line opioids.¹ In case of progressive pain, more potent opioids have to be administered. However, this step should not be taken on demand, but adjusted to the individual pain symptoms and the painkiller's effect profile. Whenever these multimodal strategies cannot achieve significant pain reduction or opioid medication is needed for a more extended period (3 months), endoscopic interventions and operative procedures must be considered, especially when pancreatic duct stenoses or stones are present. Constrictions of the bile duct and duodenum, as well as pseudocysts, raise the likelihood of extra-pancreatic painful complications. Prospective randomized trials clearly show that superior pain relief is provided by surgery, but an endoscopic intervention is usually done first. This choice is due to less invasiveness of the endoscopic procedure, and partly because gastroenterologists and endoscopists are the first to encounter these patients. This phenomenon was recently demonstrated in a study from the United States, which revealed that only a minority of patients were directed towards surgical therapy. Within the investigated time period of 4 years, only 10% of a collective of 21,000 patients with chronic pancreatitis had surgery (mainly by cholecystectomies), and only 498 patients received pancreatic resection.² Therefore, there is an urgent need that all patients with chronic pancreatitis on regular pain medication or with complications in neighbouring organs (e.g. bile duct, duodenum, portal vein) or pancreatic duct obstruction should be discussed in an interdisciplinary pancreas board comparable to the well-established tumour boards.

C6.P2

Rationale for the surgical approach

C6.S4

Chronic inflammation within the pancreas leads to progressive and mainly irreversible destruction of the pancreatic parenchyma. The morphological features reveal marked and intermittently distributed fibrosis that is variable within the pancreatic tissue. This impairment leads to endocrine and exocrine insufficiency. These issues define the therapeutic components of the operation:

C6.P3

- Relief of pain

C6.P4

• Treatment of disease-associated complications:	C6.P5
■ Symptomatic pseudocysts (when endoscopically unsuccessful):	C6.P6
Pain, nausea/vomiting, feeling of abdominal fullness	C6.P7
■ Complicated pseudocysts (when endoscopically unsuccessful):	C6.P8
■ Compression of vessels	C6.P9
■ Compression of the bile duct	C6.P10
■ Infection (abscess formation), bleeding (erosion, haemorrhage)	C6.P11
■ Stenosis of the pylorus or duodenum	C6.P12
p. 46 ■ Asymptomatic pseudocysts (when endoscopically unsuccessful):	C6.P13
■ Without spontaneous regression	C6.P14
■ With stone/stricture-associated changes in the pancreatic duct	C6.P15
■ Development of fistulae or erosive haemorrhage	C6.P16
• Preservation of endocrine and exocrine function	C6.P17
• Exclusion of a malignant neoplasm in patients with a pancreatic head mass.	C6.P18

Time aspects of operation planning

Current guidelines have not yet defined evidence-based recommendations for the ideal timing of surgery. However, based on the indications mentioned above, a reasonable step-up approach, i.e. ‘conservative–interventional–operative’ should aim to ensure an ‘early enough operation’. Therefore, experienced gastroenterologists and surgeons should identify this ‘patient-specific moment’ because late treatment of disease that has progressed is controversial and likely to compromise outcomes. Current data from a Cochrane review of prospective, randomized trials on endoscopic stenting versus surgical therapy acknowledge the superior middle- and long-term prognosis for patients who received operative therapy, especially for sustained pain control.³ Those studies are necessary to find out whether ‘early enough’ treatment is equal to ‘early’ in this context. Recent results from a randomized controlled trial ‘Early surgery versus optimal current step-up practice for chronic pancreatitis (ESCAPE)’ favour early surgery, compared to an ‘endoscopy–first approach’, amongst patients with chronic pancreatitis with a dilated main pancreatic duct and who only recently started using prescribed opioids (strong opioids for <2 months or weak opioids for <6 months), resulting in a lower pain score when followed up over 18 months.⁴ According to the Dutch Pancreatitis Study Group, a short time period between diagnosis and operation hampers progression of the disease and even ameliorates pancreatic dysfunction.⁵ A published single-centre study revealed an ideal time cut-off of 26.5 months from diagnosis to operation.⁶ Despite a low number of prospective studies and heterogeneous data, interdisciplinary change of thinking and early evaluation of a surgical approach for chronic pancreatitis appears to be justified.

Morphological changes of the pancreas are focal, segmental, or diffuse, according to the stage of the disease. Calcifications within the organ correlate with an already advanced stage. Therefore, clinical appearance and progression, associated peripancreatic complications, and the patient's overall condition determine the choice of distinct surgical approaches. In general, *drainage* can be differentiated from *resectional* procedures. These procedures have their significance in therapy algorithms and are well established in high-volume centres. Patients with chronic pancreatitis have an increased risk of pancreatic cancer that has to be considered carefully, since drainage procedures cannot provide information about malignancy in the pancreatic parenchyma.

C6.P20

There is a growing application of minimally invasive, sometimes robotically assisted, operative techniques, and their feasibility has been reported.⁷ However, data are scarce and patient selection is biased. Randomized trials indicating advantages of laparoscopic approaches are missing and their feasibility for patients with chronic pancreatitis is questionable.

C6.P21

Drainage procedures

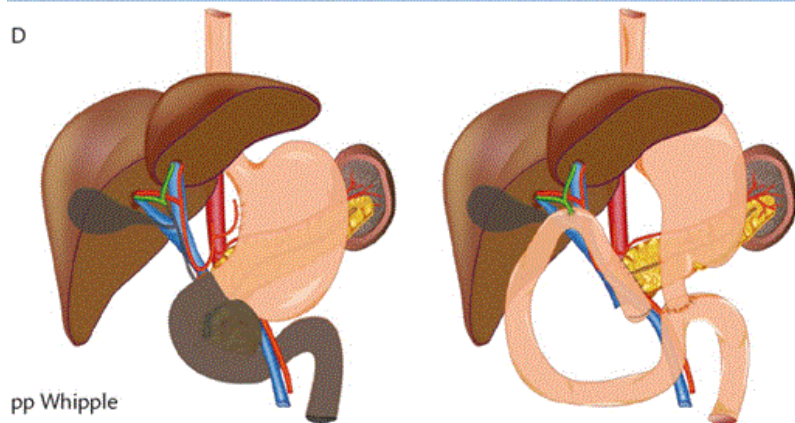
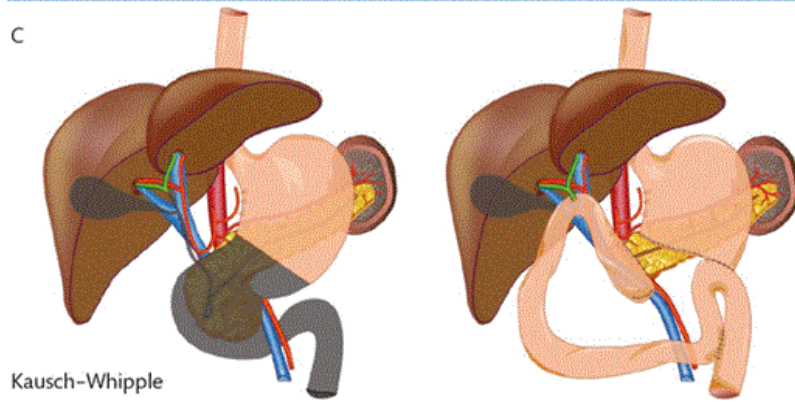
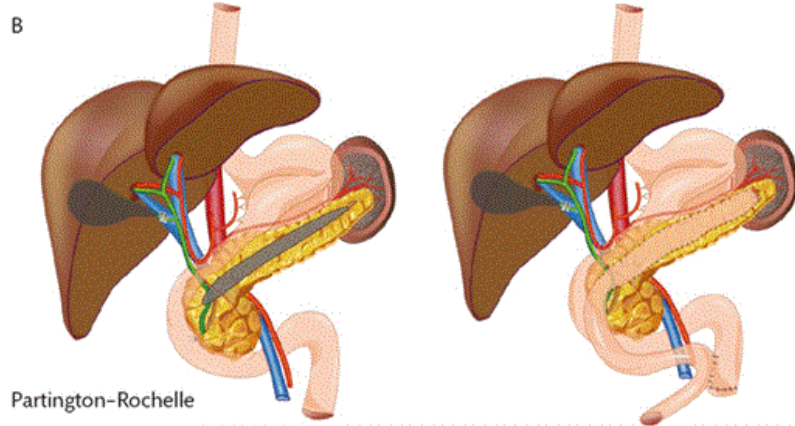
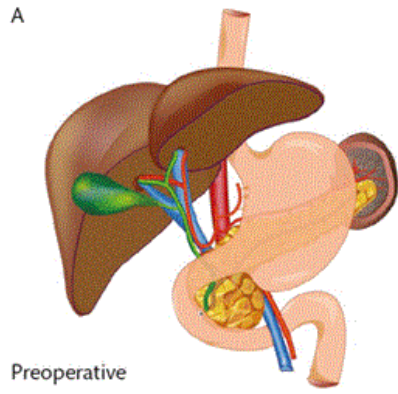
C6.S7

These procedures are used for obstructed pancreatic ducts. It has to be mentioned again that this approach does not allow for a definitive exclusion of malignancy. Furthermore, isolated drainage of the duct runs the risk of not addressing the issues associated with a pancreatic head with its inflammatory changes. It should be remembered that the pancreatic head is widely regarded as the pacemaker of the disease. Pancreatitis-associated complications, e.g. gastric, duodenal, or biliary duct obstruction and vascular compression, cannot be appropriately addressed by this kind of an operation. Therefore, drainage procedures should be employed only when the pancreatic head is not enlarged, and only when an isolated dilatation of the pancreatic duct can be found ('large duct disease'). Today, the standardized drainage procedure for relief of an obstructed pancreatic duct is an operation called the Partington–Rochelle procedure.

C6.P22

The regular anatomical situation is displayed in Figure 6.1A. The procedure, according to Partington–Rochelle, satisfies the demand for maximum preservation of pancreatic parenchyma. It is based on the operation initially described by Puestow and Gillesby that comes along with the combination of a pancreatic tail resection, longitudinal lancing of the pancreatic duct, and performance of an enteral anastomosis using a pancreatico-jejunostomy.⁸ However, the Partington–Rochelle procedure refrains from pancreatic resection but drains the duct by use of an isolated intestinal loop for a long lateral pancreatico-jejunostomy, as displayed in Figure 6.1B.⁹ This procedure has a low morbidity rate of approximately 20% and a mortality rate below 1%, together with excellent short- and long-term results. Patients report effective and sustained pain reduction in about 80% of cases over a follow-up of 15–110 months' duration.¹⁰ Permanent freedom from pain is below 60%.¹¹ If the patient is well selected, the long-term results of this procedure are often satisfactory.

C6.P23



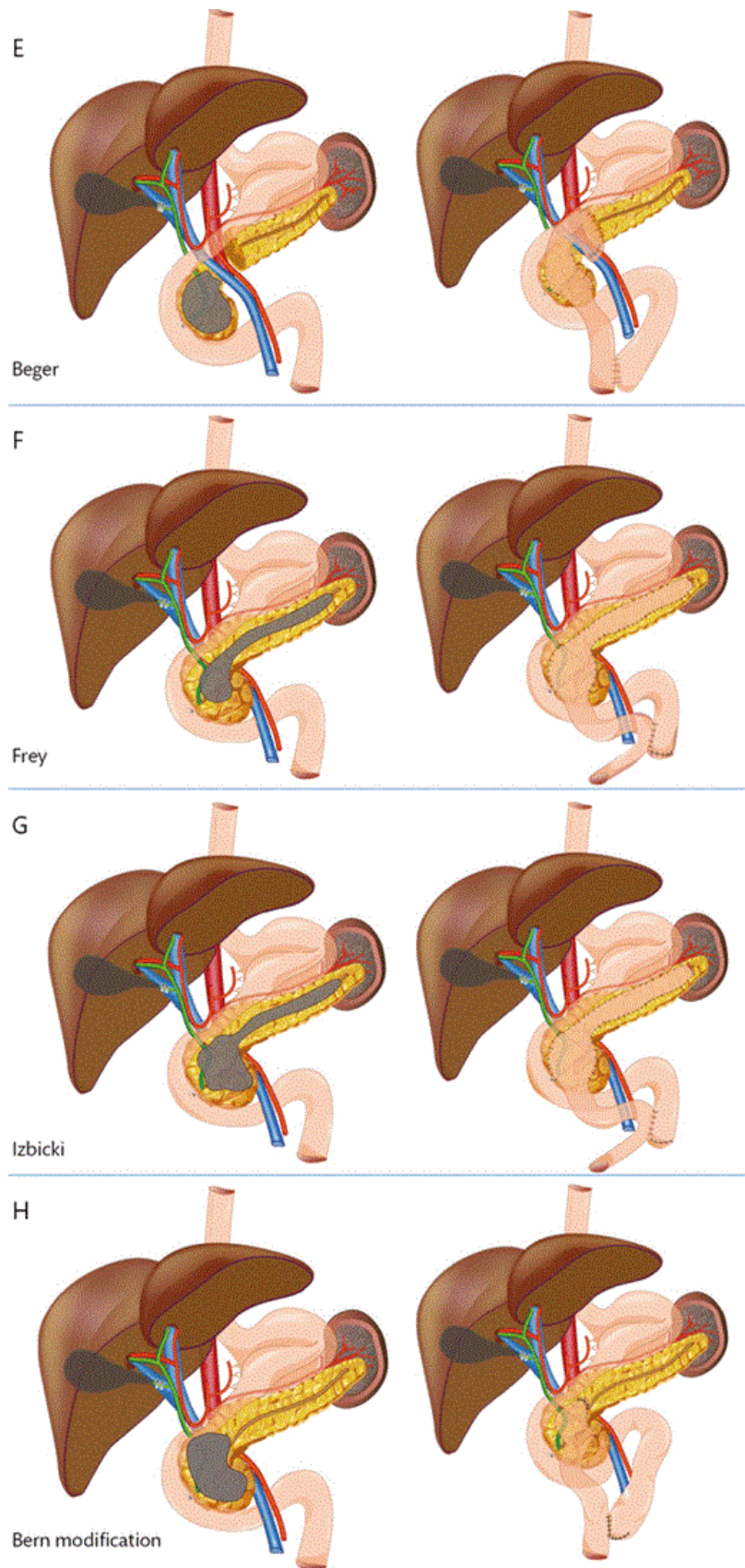


Figure 6.1 Draining and resective procedures for surgical treatment of chronic pancreatitis. (A) shows preoperative regular findings of the peripancreatic region. (B) to (H) display the distinct operative techniques; in the left column, the respective resection margins are indicated in grey; the right column shows the operative situation after the end of the reconstructive period.

Resective procedures

C6.S8

The pathological changes of the gland, aberrant anatomical peculiarities, and features of surrounding structures have to be well documented prior to surgery. Frequently, an enlarged pancreatic head can be found, triggering the inflammatory processes. This implies the necessity for a combination of both drainage and resection in most cases. Substantially, contemporary resectional procedures for chronic pancreatitis include:

C6.P24

- Partial pancreateoduodenectomy (the classical procedure according to Kausch–Whipple) C6.P25
- Partial pylorus-preserving pancreateoduodenectomy (PPPD) (according to Watson and Traverso) C6.P26
- Duodenum-preserving pancreatic head resections (according to Beger, Frey, and Büchler) C6.P27
- Total pancreatectomy. C6.P28
- Resectional plus drainage procedure C6.P29

The classic procedure according to Kausch–Whipple¹² and the pylorus-preserving modification (PPPD) described by Watson in 1944¹³ and first performed in a large patient population by Traverso and Longmire in 1978¹⁴ are well established in surgery for ↵

C6.P30

p. 47
p. 48

↵

p. 49

↵

malignancies of the pancreatic head and the ampulla of Vater. For a long time, both were also the standard surgical therapy for chronic pancreatitis. The procedures include resection of the duodenum, pancreatic head, distal bile duct, gall bladder, and distal part of the stomach in its classical version (Figure 6.1C), together with resection of the peripancreatic and periduodenal lymph nodes and those in the hepatoduodenal ligament, right of the mesenteric axis, and coeliac trunk. The pylorus-preserving version retains the complete stomach together with the first duodenal segment (Figure 6.1D) to ameliorate the physiological problems of gastric emptying and reduce acid reflux in the long term. Nonetheless, numerous studies have confirmed the equivalence of both techniques, especially with regard to quality of life and perioperative complication rates. Long-term pain relief can be achieved in 50–95% of patients.¹⁵ In specialized centres, morbidity is around 20–50% and mortality is below 5% for both procedures.^{11,16} Nevertheless, long-term follow-up has revealed somewhat unsatisfactory results, e.g. gastrointestinal disorders (dumping syndrome and diarrhoea), peptic ulcers, problems of the biliodigestive anastomosis, development of diabetes mellitus.

As the oncological radical resection criteria are not necessary for chronic pancreatitis, organ-preserving operative methods have come to the fore. By ‘local resection’, these methods aim for maximal preservation of pancreatic tissue, and therefore reduction in the feared long-term side effects of loss of endocrine and exocrine function.

C6.P31

In the 1970s, Beger first described the duodenum-preserving pancreatic head resection (DPPHR).¹⁷ This procedure includes subtotal resection of the pancreatic head but preserves the duodenum and bile duct. Similar to the Kausch–Whipple procedure, the pancreas is cut in line with the portal axis, which allows for distinction between the head and the corpus/tail of the gland, thereby decompressing the portomesenteric vein. Next, the pancreas is drained by anastomoses of the pancreatic body and the subtotally resected (enucleated) head to an isolated Roux-en-Y jejunal loop (Figure 6.1E). This method is suitable for patients with pain resistant to medical treatment and inflammatory changes in the pancreatic head, as well as for patients with pancreatitis-associated changes such as obstruction of the main pancreatic duct, bile duct, or portal vein dorsal to the pancreas or duodenum. The classical Beger procedure can be combined with internal distal bile duct drainage in the resected pancreatic head cavity and with an opening and drainage of the main pancreatic duct in the body or tail of the pancreas if strictures are present. In these cases, a lateral pancreatico-jejunostomy is added.

C6.P32

Studies report long-term pain relief in 70–95% of patients, morbidity of 15–45%, and mortality below 2%.^{11,18} Whereas DPPHR has gained acceptance as a safe method in Europe, there are reservations regarding its effectiveness, particularly in North America.

The so-called extended drainage procedure according to Frey¹⁹ uses a longitudinal incision of the pancreatic duct plus a more limited resection (enucleation) of the pancreatic head, together with a Roux-en-Y jejunal pancreatico-jejunostomy reconstruction, as shown in Figure 6.1F. The rationale of this method is the assumption that pain persists in case of incomplete decompression of the pancreatic duct within the pancreatic head after drainage surgery. In contrast to the Beger procedure, the Frey technique refrains from surgical sectioning of the pancreatic parenchyma in the portal vein axis. Therefore, this method might be technically easier, but the problem of vascular compression is not addressed. Together with a morbidity rate of about 40% and a mortality rate below 1%, 75–90% of patients benefit from long-term pain reduction.²⁰

C6.P33

At the end of the last century, Izbicki introduced another modification of the DPPHR.²¹ Both the pancreatic head and the uncinate process are subtotally resected, as displayed in Figure 6.1G. However, there is no surgical sectioning in line with the portal axis. To optimize drainage of the main pancreatic duct, an additional V-shape excision of the anterior part of the pancreas and the pancreatic duct is performed, respectively. The anatomical reconstruction is done analogous to the techniques of Frey and Partington–Rochelle with a longitudinal pancreatico-jejunostomy. Especially in cases with small pancreatic ducts and no inflammatory mass ('small duct disease'; approximately 5% of patients), this method is a suitable therapeutic option to drain even ducts of the second and third order directly. Prospective data show a low morbidity rate of 20%, no perioperative mortality, and effective pain treatment, together with a good quality of life in >70% of this special patient population.²²

C6.P34

The advantages of the Beger and Frey techniques are combined in the Berne modification (Büchler operation) of DPPHR first reported in 2001.²³ The pancreatic surgical sectioning ventral of the portal axis and the longitudinal pancreatico-jejunostomy are avoided, but a subtotal resection of the pancreatic head is done similarly to, and as extensively as in, the Beger procedure. During the reconstruction, a Roux-en-Y intestinal loop is anastomosed to the subtotally resected (enucleated) head of the gland, as shown in Figure 6.1H. The perioperative risk of 20% morbidity and 1% in-hospital mortality is comparable to that of the other procedures.²¹ This technique can be the most organ-sparing and the simplest technical alternative for optimal drainage of the main pancreatic duct and optionally of the bile duct within the enucleated pancreatic head cavity.

C6.P35

In cases where there is segmental involvement of chronic pancreatitis in the pancreatic body or tail without changes in the pancreatic head are found in chronic pancreatitis, left-sided pancreatic resection may be indicated. Whenever possible, the spleen should be preserved. This procedure does not demand any reconstruction, as both the pancreatic duct and bile duct drain unchanged via the papilla into the duodenum. However, if the pancreatic head is also affected, with potential alterations of the main pancreatic duct, a pancreatico-jejunostomy is recommended to avoid a post-operative pancreatic fistula. Within this selected patient group, morbidity ranges from 15% to 30%, mortality is below 5%, and pain relief can be achieved in about 90% of cases.²⁴ In the rather rare case of a circumscribed lesion in the pancreatic body, an isolated segmental resection can be performed.²⁵ This procedure shows a low rate of post-operative endocrine and exocrine insufficiency, and morbidity and mortality are comparable. The so-called Child resection with a subtotal pancreatic resection leaving just a small margin of parenchyma at the duodenum to safeguard its blood flow is no longer performed, because it is not superior to drainage procedures and also results in major endocrine and exocrine insufficiency.

C6.P36

All partial resection techniques can be extended to a total pancreatectomy. This approach, together with autologous islet cell transplantation, is a promising therapeutic concept. Studies revealed better blood sugar adjustment and decreased need for painkillers, and therefore a significantly improved quality of life.²⁶

C6.P37

Nevertheless, this option is still reserved for a highly selective group of patients and is available only in a few centres with expert knowledge on islet isolation.

p. 50 **Comparative evaluation of recent analyses on the choice of surgical procedure**

C6.S9

The increasing importance of operative intervention for chronic pancreatitis raises the question regarding which procedure provides the best prognosis to the patient. With regard to important studies on this issue, the operative techniques can be compared despite distinct limitations.

C6.P38

The first prospective investigations of the DPPHR, according to Beger, appeared promising and showed advantages, compared to the classical Kausch–Whipple procedure, concerning the course of pain, weight gain, and function preservation.^{27,28} However, after examining the recent literature, the interpretation of these data in the long term has to be carefully revisited. Relevant parameters, e.g. course of pain, quality of life,²⁹ and endocrine and exocrine insufficiency,³⁰ showed no differences in meta-analyses when pylorus-preserving versus classical resection were compared. Therefore, the results from the prospective randomized ChroPac trial were awaited. This multicentre study of 250 patients reported comparable results of partial duodenopancreatectomy (125 patients) and DPPHR (125 patients) with regard to quality of life, post-operative rate of fistulae, length of hospital stay, and exocrine and endocrine functioning during a 2-year observation.³¹ The controversy regarding this trial especially criticized the comparison of three different duodenum-preserving procedures (Beger, Frey, and Bern) with two techniques of partial duodenopancreatectomy (classical and pylorus-preserving Whipple). Therefore, the patient group can be assumed to be relevantly heterogeneous.³² The final assessment of both operative strategies remains challenging, especially in the long term. This is why the surgeons' expertise is important before planning an approach considering the extent of involvement of the pancreas and other organs, as well as anatomical findings.

C6.P39

Only the duodenum-preserving variants were also compared. Recent investigations of the Beger and Frey procedures did not reveal significant differences with regard to the defined endpoints of endocrine and exocrine insufficiency, pain reduction, and quality of life in the long term.³³ These results are in line with previously published data from a prospective randomized study from 2005.³⁴

C6.P40

Next, comparison between the Beger and Bern techniques showed no differences in post-operative quality of life and pain reduction in short-, medium-,³⁵ and long-term observations.³⁶

C6.P41

Hitherto, the techniques of Bern and Frey have not been compared.

C6.P42

Figure 6.2 contains up-to-date information on relevant trials and meta-analyses.^{16,20,27,28,30,34,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51} However, the included studies show heterogeneity and patient numbers decrease considerably during long-term follow-up. This is why general recommendations for or against any procedure cannot be based just on anatomical findings, aetiology of disease, and its symptoms.

C6.P43

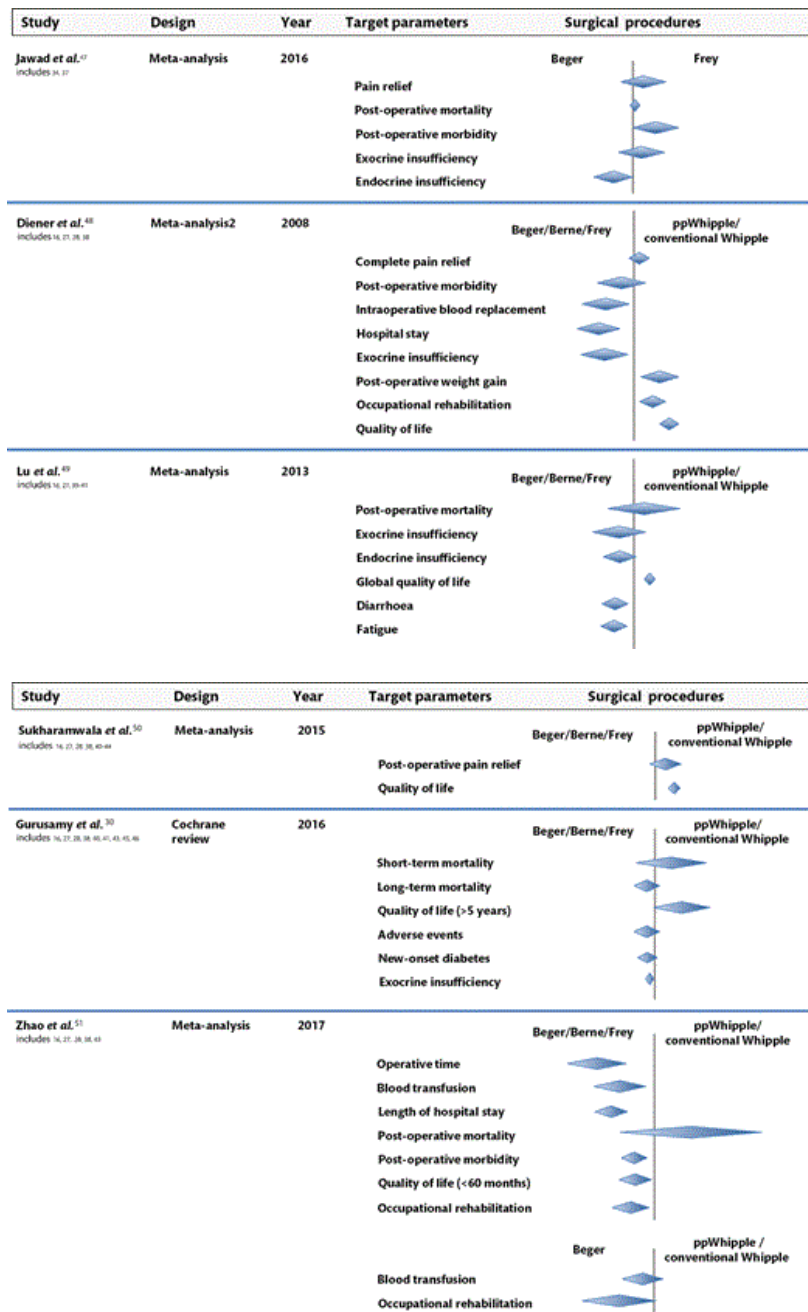


Figure 6.2 Forest plot overview of relevant review articles and meta-analyses. Synopsis of forest plots of review articles and meta-analyses in order to investigate surgical procedures in the treatment of chronic pancreatitis (list of individual examined target parameters).

Surgery for pseudocysts

C6.S10

Pseudocysts are the most frequent pancreatitis-associated complication (up to 40%). They either develop due to retention of pancreatic fluid in side branches of the pancreatic duct or are based on recurrent inflammatory episodes with consecutive autodigestion of the pancreatic tissue and rupture of pancreatic duct structures. Nowadays, pseudocysts are usually treated endoscopically, and surgical approaches are required in case of unsuccessful endoscopic drainage and in complex pseudocysts. The latter might have multiple cysts accompanied by changes of the pancreatic duct, e.g. strictures, stones, or discontinuation, respectively. Therefore, surgical planning includes both considerations of the morphological changes of the pancreas and peripancreatic structures and definitive treatment of the cyst. External draining procedures are rarely performed within the context of chronic pancreatitis. Internal draining procedures include cystogastrostomy, cystoduodenostomy, and cystojejunostomy. Generally, the anastomosis should be placed at the lowest part of the cyst to achieve maximally effective drainage of the secretions. It has to be noted that due to missing prospective data comparing any of these techniques, decision-making is dependent on the expertise and experience of the surgeon. Laparoscopic drainage of pseudocysts is technically possible, and the reported complication rate has been reported to be below 10%.⁵² Up to now, their place has not been finally clarified, but laparoscopic procedures are an alternative to open draining procedures due to their safety and effectiveness, with recurrence rates of between 0% and 13%.⁵³

C6.P44

Long-term success after surgical treatment

C6.S11

Results after operative procedures must be sustained in the long-term course and maintain superiority to alternative medical options and interventional methods. So-called 'internal drainages' have almost completely replaced percutaneous drainage of pseudocysts because of their high recurrence rate of up to 70%. The internal drains are placed by use of a transgastric, transduodenal, or transpapillary stent. The results of these procedures are difficult to assess because the acute and chronic formation of the cysts, and therefore their medical nomenclature, is inconsistent in the published literature. Studies confirm symptom resolution in up to 91%, together with a mortality rate of below 1% and long-term recurrence in 18% of cases.⁵⁴ Considering the surgical approaches, 'external' drainage has a low prospect of success and is used only for pseudocysts in acute pancreatitis. 'Internal drainage' is associated with a low recurrence rate of 12% within an 8-year course, together with a mortality rate of 2.5%—all dependent on localization and complexity of the cyst.⁵⁵ Therefore, success rates of surgery appear to be better, compared to endoscopic procedures, albeit with higher perioperative lethality. Randomized data on operative, endoscopic, and interventional drainage of pseudocysts directly comparing the pros and cons do not exist.

C6.P45

In *pain management* of chronic pancreatitis, interventional or operative therapeutic escalation follows exhaustive medical treatment, starting with peripherally effective drugs and stepping up to centrally potent agents. Endoscopically performed 'plexus blocks' for interruption of pain sensation in the sensory nerves of the coeliac ganglion succeed in up to 60%.^{56,57} However, the benefit is frequently only temporary and the cause of pain is not abolished. Recent reports indicate low complication rates and at least transient pain decrease for operative transthoracic splanchnotomy and splanchnicectomy, even though the effect is inferior, compared to similar treatment in patients with pancreatic cancer.⁵⁸

C6.P46

The rationale for endoscopic stenting is the decompression of the pancreatic duct and consecutive pressure release of the segment behind a constriction. Therefore, stenting is especially effective in the

C6.P47

p. 51
p. 52

↳

case of dominant strictures and a dilated duct. This interventional treatment leads to significant pain reduction in many patients. Data from a meta-analysis, including 16 studies, was associated with immediate pain

reduction in 88% of patients following endoscopic therapy, but the effect decreased to 67% within a (mean) long-term follow-up of 47 months.⁵⁹ Extracorporeal shock wave lithotripsy can be considered for uncomplicated chronic pancreatitis, depending on the size of the stones. During a follow-up period of 77 months, this sequential approach showed pain relief and freedom from pain in 48–91%, respectively.⁶⁰ There exist two precedent-setting prospective randomized trials directly comparing surgical and endoscopic approaches. With regard to treatment of chronic pain, the first published data confirmed the superiority of surgery (80% resectional and 20% drainage procedures in the patient cohort receiving surgery, whereas endotherapy included 52% sphincterotomy and stenting and/or 23% stone removal). Whereas partial pain decrease was reported in >90% in both groups, complete freedom from pain was attained in 42% of surgically and 52% of endoscopically treated patients within the first year. However, the 3- and 5-year results revealed marked superiority of the operative treatment in terms of patients being pain-free (41% versus 11% and 37% versus 14%, respectively).⁶¹ Furthermore, there were significantly more so-called ‘non-responders’ in the interventionally treated patient group. The second study also demonstrated the advantage of operative therapy with regard to partial/complete pain reduction, comparing only procedures of surgical drainage to endoscopic stenting. This investigation was even stopped prematurely after an interim analysis because completion with the originally planned number of patients was ethically unjustifiable.⁶² The long-term results collected within this patient cohort showed that the initially operated patients suffered less frequently from pain (38% versus 80%) and rarely needed additional interventions or operations during a follow-up period of 79 months. Almost half of endoscopically treated patients finally received surgery.⁶³ Recent data from a meta-analysis support these observations and not only back an extension of indications, but also support early surgery after diagnosis. The results clearly indicate a larger group of patients who are pain-free after surgery with 4-fold lower risk of pain progression than after endoscopic procedures.⁶⁴

Conclusion

Operative strategies—most notably DPPHR—for patients with chronic pancreatitis are demanding. These procedures require much surgical experience. Due to the variable degree of inflammation and adherence to the portomesenteric vein, transection of the pancreas might be a challenge leading to severe bleeding. Also, subtotal enucleation of the pancreatic head (Beger, Büchler), if adequately performed, is ambitious and time-consuming due to the need for many sutures to control bleeding in the excavated pancreatic head. While it may be challenging to figure out the balance between too much and too little, it is essential for the effectiveness and overall success of the operation. Since most surgeons are well trained and perform resectional operations such as the Whipple procedure or partial PPPD in many cancer patients, they prefer to perform these techniques, rather than DPPHR. Nevertheless, organ preservation should lead to a better outcome because it is much closer to the normal physiological situation. The central insight from the last years is to allocate patients for surgical therapy to a high-volume centre to increase the rates of success and significantly reduce perioperative morbidity and mortality.

Simultaneously, the importance of surgery for chronic pancreatitis has increased, based on three fundamental perceptions:

- Early surgical therapy pre-emptively prevents increased tissue damage and therefore ensures better functioning of the remaining pancreas after surgery.
- Organ-preserving operative methods show more effective and sustained pain control, as compared to endoscopic and interventional approaches.
- The risk of malignant transformation is reduced.

C6.S12

C6.P48

C6.P49

C6.P50

C6.P51

C6.P52

Therefore, interdisciplinary boards have to be established in which all patients admitted to hospital in the outpatient clinic or for inpatient therapy are discussed, and the best treatment concepts worked out, with consideration of surgery at an earlier stage than ever before.

1. Olesen SS, Bouwense SA, Wilder-Smith OH, van Goor H, Drewes AM. Pregabalin reduces pain in patients with chronic pancreatitis in a randomized, controlled trial. *Gastroenterology* 2011;**141**:536–43.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
2. Bliss LA, Yang CJ, Eskander MF, *et al.* Surgical management of chronic pancreatitis: current utilization in the United States. *HPB (Oxford)* 2015;**17**:804–10.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
3. Ahmed Ali U, Pahlplatz JM, Nealon WH, van Goor H, Gooszen HG, Boermeester MA. Endoscopic or surgical intervention for painful obstructive chronic pancreatitis. *Cochrane Database Syst Rev* 2015;**3**:CD007884.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
4. Issa Y, Kempeneers MA, Bruno MJ, *et al.* Effect of early surgery vs endoscopy-first approach on pain in patients with chronic pancreatitis: the ESCAPE randomized clinical trial. *JAMA* 2020;**323**:237–47.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
5. Ahmed Ali U, Nieuwenhuijs VB, van Eijck CH, *et al.* Clinical outcome in relation to timing of surgery in chronic pancreatitis: a nomogram to predict pain relief. *Arch Surg* 2012;**147**:925–32.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
6. Yang CJ, Bliss LA, Freedman SD, *et al.* Surgery for chronic pancreatitis: the role of early surgery in pain management. *Pancreas* 2015;**44**(5):819–23.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
7. Kirks RC, Lorimer PD, Fruscione M, *et al.* Robotic longitudinal pancreaticojejunostomy for chronic pancreatitis: comparison of clinical outcomes and cost to the open approach. *Int J Med Robot* 2017;13.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
8. Puestow CB, Gillesby WJ. Retrograde surgical drainage of pancreas for chronic relapsing pancreatitis. *AMA Arch Surg* 1958;**76**:898–907.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
9. Partington PF, Rochelle RE. Modified Puestow procedure for retrograde drainage of the pancreatic duct. *Ann Surg* 1960;**152**:1037–43.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
10. van der Gaag NA, Gouma DJ, van Gulik TM, Busch OR, Boermeester MA. Review article: surgical management of chronic pancreatitis. *Aliment Pharmacol Ther* 2007;26 Suppl 2:221–32.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
11. Hartel M, Tempia-Caliera AA, Wente MN, Z'Graggen K, Friess H, Buchler MW. Evidence-based surgery in chronic pancreatitis. *Langenbecks Arch Surg* 2003;**388**:132–9.
[Google Scholar](#) [WorldCat](#)
12. Whipple AO, Parsons WB, Mullins CR. Treatment of carcinoma of the ampulla of Vater. *Ann Surg* 1935;**102**:763–79.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
- p. 53 13. Kenneth W. Carcinoma of ampulla of vater successful radical resection. *BJS* 1944:368–73.
[Google Scholar](#) [WorldCat](#)
14. Traverso LW, Longmire WP, Jr. Preservation of the pylorus in pancreaticoduodenectomy: a follow-up evaluation. *Ann Surg* 1980;**192**:306–10.

15. Traverso LW, Kozarek RA. Pancreatoduodenectomy for chronic pancreatitis: anatomic selection criteria and subsequent long-term outcome analysis. *Ann Surg* 1997;**226**:429–35; discussion 35–8.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

16. Farkas G, Leindler L, Daroczi M, Farkas G, Jr. Prospective randomised comparison of organ-preserving pancreatic head resection with pylorus-preserving pancreaticoduodenectomy. *Langenbecks Arch Surg* 2006;**391**:338–42.

[Google Scholar](#) [WorldCat](#)

17. Beger HG, Krautzberger W, Gogler H. [Resection of the head of the pancreas (cephalic pancreatectomy) with conservation of the duodenum in chronic pancreatitis, tumours of the head of the pancreas and compression of the common bile duct (author's transl)]. *Chirurgie* 1981;**107**:597–604.

[Google Scholar](#) [WorldCat](#)

18. Bachmann K, Kutup A, Mann O, Yekebas E, Izbicki JR. Surgical treatment in chronic pancreatitis timing and type of procedure. *Best Pract Res Clin Gastroenterol* 2010;**24**:299–310.

[Google Scholar](#) [WorldCat](#) [Web of Science](#)

19. Frey CF, Smith GJ. Description and rationale of a new operation for chronic pancreatitis. *Pancreas* 1987;**2**:701–7.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

20. Izbicki JR, Bloechle C, Knoefel WT, Kuechler T, Binmoeller KF, Broelsch CE. Duodenum-preserving resection of the head of the pancreas in chronic pancreatitis. A prospective, randomized trial. *Ann Surg* 1995;**221**:350–8.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

21. Izbicki JR, Bloechle C, Broering DC, Kuechler T, Broelsch CE. Longitudinal V-shaped excision of the ventral pancreas for small duct disease in severe chronic pancreatitis: prospective evaluation of a new surgical procedure. *Ann Surg* 1998;**227**:213–19.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

22. Yekebas EF, Bogoevski D, Honarpisheh H, *et al.* Long-term follow-up in small duct chronic pancreatitis: a plea for extended drainage by 'V-shaped excision' of the anterior aspect of the pancreas. *Ann Surg* 2006;**244**:940–6; discussion 946–8.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

23. Gloor B, Friess H, Uhl W, Buchler MW. A modified technique of the Beger and Frey procedure in patients with chronic pancreatitis. *Dig Surg* 2001;**18**:21–5.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

24. Sakorafas GH, Sarr MG, Rowland CM, Farnell MB. Postobstructive chronic pancreatitis: results with distal resection. *Arch Surg* 2001;**136**:643–8.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

25. Muller MW, Assfalg V, Michalski CW, Buchler P, Kleeff J, Friess H. [Middle segmental pancreatic resection: an organ-preserving option for benign lesions]. *Chirurg* 2009;**80**:14–21.

[Google Scholar](#) [WorldCat](#)

26. Wilson GC, Sutton JM, Smith MT, *et al.* Completion pancreatectomy and islet cell autotransplantation as salvage therapy for patients failing previous operative interventions for chronic pancreatitis. *Surgery* 2015;**158**:872–8; discussion 979–80.

[Google Scholar](#) [WorldCat](#)

27. Klempa I, Spatny M, Menzel J, *et al.* [Pancreatic function and quality of life after resection of the head of the pancreas in chronic pancreatitis. A prospective, randomized comparative study after duodenum preserving resection of the head of the pancreas versus Whipple's operation]. *Chirurg* 1995;**66**:350–9.

[Google Scholar](#) [WorldCat](#)

28. Buchler MW, Friess H, Muller MW, Wheatley AM, Beger HG. Randomized trial of duodenum-preserving pancreatic head resection versus pylorus-preserving Whipple in chronic pancreatitis. *Am J Surg* 1995;**169**:65–9; discussion 69–70.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
29. Yin Z, Sun J, Yin D, Wang J. Surgical treatment strategies in chronic pancreatitis: a meta-analysis. *Arch Surg* 2012;**147**:961–8.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
30. Gurusamy KS, Lusk C, Halkias C, Davidson BR. Duodenum-preserving pancreatic resection versus pancreaticoduodenectomy for chronic pancreatitis. *Cochrane Database Syst Rev* 2016 Feb 3;2(2):CD011521.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
31. Diener MK, Huttner FJ, Kieser M, *et al.* Partial pancreatoduodenectomy versus duodenum-preserving pancreatic head resection in chronic pancreatitis: the multicentre, randomised, controlled, double-blind ChroPac trial. *Lancet* 2017;**390**:1027–37.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
32. Beger HG, Mayer B. [Duodenum-preserving pancreatic head resection in chronic pancreatitis: Limitations of the Heidelberg multicenter ChroPac study]. *Chirurg* 2018;**89**:392–6.
[Google Scholar](#) [WorldCat](#)
33. Bachmann K, Tomkoetter L, Erbes J, *et al.* Beger and Frey procedures for treatment of chronic pancreatitis: comparison of outcomes at 16-year follow-up. *J Am Coll Surg* 2014;**219**:208–16.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
34. Strate T, Taherpour Z, Bloechle C, *et al.* Long-term follow-up of a randomized trial comparing the beger and frey procedures for patients suffering from chronic pancreatitis. *Ann Surg* 2005;**241**:591–8.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
35. Koninger J, Seiler CM, Sauerland S, Wente MN, Reidel MA, Muller MW, *et al.* Duodenum-preserving pancreatic head resection—a randomized controlled trial comparing the original Beger procedure with the Berne modification (ISRCTN No. 50638764). *Surgery*. 2008;**143**(4):490–8.
[Google Scholar](#) [WorldCat](#)
36. Klaiber U, Alldinger I, Probst P, *et al.* Duodenum-preserving pancreatic head resection: 10-year follow-up of a randomized controlled trial comparing the Beger procedure with the Berne modification. *Surgery* 2016;**160**:127–35.
[Google Scholar](#) [WorldCat](#)
37. Keck T, Wellner UF, Riediger H, *et al.* Long-term outcome after 92 duodenum-preserving pancreatic head resections for chronic pancreatitis: comparison of Beger and Frey procedures. *J Gastrointest Surg* 2010;**14**:549–56.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
38. Izbicki JR, Bloechle C, Broering DC, Knoefel WT, Kuechler T, Broelsch CE. Extended drainage versus resection in surgery for chronic pancreatitis: a prospective randomized trial comparing the longitudinal pancreaticojejunostomy combined with local pancreatic head excision with the pylorus-preserving pancreatoduodenectomy. *Ann Surg* 1998;**228**:771–9.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
39. McClaine RJ, Lowy AM, Matthews JB, *et al.* A comparison of pancreaticoduodenectomy and duodenum-preserving head resection for the treatment of chronic pancreatitis. *HPB (Oxford)* 2009;**11**:677–83.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
40. Muller MW, Friess H, Martin DJ, Hinz U, Dahmen R, Buchler MW. Long-term follow-up of a randomized clinical trial comparing Beger with pylorus-preserving Whipple procedure for chronic pancreatitis. *Br J Surg* 2008;**95**:350–6.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

41. Strate T, Bachmann K, Busch P, *et al.* Resection vs drainage in treatment of chronic pancreatitis: long-term results of a randomized trial. *Gastroenterology* 2008;**134**:1406–11.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
42. Belina F, Fronck J, Ryska M. Duodenopancreatectomy versus duodenum-preserving pancreatic head excision for chronic pancreatitis. *Pancreatology* 2005;**5**:547–52.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
43. Keck T, Adam U, Makowiec F, *et al.* Short- and long-term results of duodenum preservation versus resection for the management of chronic pancreatitis: a prospective, randomized study. *Surgery* 2012;**152**(3 Suppl 1):S95–102.
[Google Scholar](#) [WorldCat](#)
44. Mobius C, Max D, Uhlmann D, *et al.* Five-year follow-up of a prospective non-randomised study comparing duodenum-preserving pancreatic head resection with classic Whipple procedure in the treatment of chronic pancreatitis. *Langenbecks Arch Surg* 2007;**392**:359–64.
[Google Scholar](#) [WorldCat](#)
- p. 54 45. Bachmann K, Tomkoetter L, Kutup A, *et al.* Is the Whipple procedure harmful for long-term outcome in treatment of chronic pancreatitis? 15-years follow-up comparing the outcome after pylorus-preserving pancreatoduodenectomy and Frey procedure in chronic pancreatitis. *Ann Surg* 2013;**258**:815–20; discussion 820–1.
[PubMed](#) [Web of Science](#)
46. Friess HM, MW; Buchler, MW. Duodenum-preserving resection of the head of the pancreas: the future. *Dig Surg* 1994;**11**(3–6):318–24.
[Google Scholar](#) [WorldCat](#)
47. Jawad ZAR, Tsim N, Pai M, *et al.* Short and long-term post-operative outcomes of duodenum preserving pancreatic head resection for chronic pancreatitis affecting the head of pancreas: a systematic review and meta-analysis. *HPB (Oxford)* 2016;**18**:121–8.
[Google Scholar](#) [WorldCat](#)
48. Diener MK, Rahbari NN, Fischer L, Antes G, Buchler MW, Seiler CM. Duodenum-preserving pancreatic head resection versus pancreatoduodenectomy for surgical treatment of chronic pancreatitis: a systematic review and meta-analysis. *Ann Surg* 2008;**247**:950–61.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
49. Lu WP, Shi Q, Zhang WZ, Cai SW, Jiang K, Dong JH. A meta-analysis of the long-term effects of chronic pancreatitis surgical treatments: duodenum-preserving pancreatic head resection versus pancreatoduodenectomy. *Chin Med J (Engl)* 2013;**126**:147–53.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
50. Sukharamwala PB, Patel KD, Teta AF, *et al.* Long-term outcomes favor duodenum-preserving pancreatic head resection over pylorus-preserving pancreaticoduodenectomy for chronic pancreatitis: a meta-analysis and systematic review. *Am Surg* 2015;**81**:909–14.
[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)
51. Zhao X, Cui N, Wang X, Cui Y. Surgical strategies in the treatment of chronic pancreatitis: an updated systematic review and meta-analysis of randomized controlled trials. *Medicine (Baltimore)* 2017;**96**:e6220.
[Google Scholar](#) [WorldCat](#)
52. Oida T, Mimatsu K, Kano H, *et al.* Laparoscopic cystogastrostomy via the posterior approach for pancreatic pseudocyst drainage. *Hepatogastroenterology* 2011;**58**(110–111):1771–5.
[Google Scholar](#) [WorldCat](#) [PubMed](#)
53. Hindmarsh A, Lewis MP, Rhodes M. Stapled laparoscopic cystogastrostomy: a series with 15 cases. *Surg Endosc*

2005;**19**:143–7.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

54. Cahen D, Rauws E, Fockens P, Weverling G, Huibregtse K, Bruno M. Endoscopic drainage of pancreatic pseudocysts: long-term outcome and procedural factors associated with safe and successful treatment. *Endoscopy* 2005;**37**:977–83.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

55. Rosso E, Alexakis N, Ghaneh P, *et al.* Pancreatic pseudocyst in chronic pancreatitis: endoscopic and surgical treatment. *Dig Surg* 2003;**20**:397–406.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

56. Kaufman M, Singh G, Das S, *et al.* Efficacy of endoscopic ultrasound-guided celiac plexus block and celiac plexus neurolysis for managing abdominal pain associated with chronic pancreatitis and pancreatic cancer. *J Clin Gastroenterol* 2010;**44**:127–34.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

57. Puli SR, Reddy JB, Bechtold ML, Antillon MR, Brugge WR. EUS-guided celiac plexus neurolysis for pain due to chronic pancreatitis or pancreatic cancer pain: a meta-analysis and systematic review. *Dig Dis Sci* 2009;**54**:2330–7.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

58. Bhutiani N, Cheadle GA, Bahr MH, Vitale GC. Comparative efficacy of bilateral thoracoscopic splanchnicectomy for intractable pain secondary to pancreatic cancer vs chronic pancreatitis. *J Am Coll Surg* 2017;**224**:566–71.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

59. Jafri M, Sachdev A, Sadiq J, *et al.* Efficacy of endotherapy in the treatment of pain associated with chronic pancreatitis: a systematic review and meta-analysis. *JOP* 2017;**18**:125–32.

[Google Scholar](#) [WorldCat](#) [PubMed](#)

60. Guda NM, Partington S, Freeman ML. Extracorporeal shock wave lithotripsy in the management of chronic calcific pancreatitis: a meta-analysis. *JOP* 2005;**6**:6–12.

[Google Scholar](#) [WorldCat](#) [PubMed](#)

61. Dite P, Ruzicka M, Zboril V, Novotny I. A prospective, randomized trial comparing endoscopic and surgical therapy for chronic pancreatitis. *Endoscopy* 2003;**35**:553–8.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

62. Cahen DL, Gouma DJ, Nio Y, *et al.* Endoscopic versus surgical drainage of the pancreatic duct in chronic pancreatitis. *N Engl J Med* 2007;**356**:676–84.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

63. Cahen DL, Gouma DJ, Laramée P, *et al.* Long-term outcomes of endoscopic vs surgical drainage of the pancreatic duct in patients with chronic pancreatitis. *Gastroenterology* 2011;**141**:1690–5.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)

64. Jawad ZAR, Kyriakides C, Pai M, *et al.* Surgery remains the best option for the management of pain in patients with chronic pancreatitis: a systematic review and meta-analysis. *Asian J Surg* 2017;**40**:179–85.

[Google Scholar](#) [WorldCat](#) [PubMed](#) [Web of Science](#)