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REVIEW ARTICLE

# Chronic Pancreatitis: A Review

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**Abstract** This is to incorporate the recent trends in chronic pancreatitis. Extensive literature search was done from Pubmed and Ovid SP. Full text articles and abstracts related to chronic pancreatitis were reviewed and the article was prepared. Chronic pancreatitis is evolving fast on its etiology and treatment areas. The main etiological factors are pointing towards genetic, alcohol, and smoking. Autoimmune has also been added as a cause. Endoscopic ultra sound (EUS) becoming the standard diagnostic procedure. Surgery is becoming the treatment of choice for pain and mechanical complications and not the endotherapy in the long-term follow-up. The numbers of surgeries are getting narrowed down. The two etiological groups of chronic pancreatitis namely alcohol + smoking and genetic getting clearer, where the later group present at an early age. Endoscopic ultrasound and imaging with secretin is diagnostic of chronic pancreatitis before the structural changes. Endotherapy is found to be inferior to surgery in long-term pain relief. Diagnostic criteria for autoimmune pancreatitis are established. Pancreaticogenic diabetes (Type3c) and its problem associated with fat malabsorption are being understood.

**Keywords** Chronic pancreatitis · Alcohol and smoking · Early diagnosis · Resection and drainage surgery · Complications of chronic pancreatitis

## Introduction and Definition

Chronic pancreatitis (CP) is a chronic, progressive, irreversible benign inflammatory process, ending in structural changes with replacement of functional exocrine and endocrine parenchyma by a fibrotic and inflammatory tissue, often evident as an inflammatory mass. Besides the above, there is calcification, stone formation, ductal dilatation, and stricture formation. In contrast to AP where the gland is normal before the attack and can return to normal after resolution in CP, the gland is abnormal before and after the attack [1].

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## Etiology

The pathogenesis leading to CP is unclear so far and is gradually evolving. The major predisposing risk factors—toxic-metabolic, idiopathic, genetic, autoimmune, and obstructive—are described as TIGAR-O system. Work on Protein Serin-1 (PRSS1) gene, serine protease inhibitor, Kazal type 1 (SPINK1), cystic fibrosis trans membrane conductance regulator (CFTR) gene, and CASR (calcium-sensing receptor) have firmly established the pivotal role of prematurely activated trypsin within the pancreas in the etiology of CP [2]. According to an Indian study on tropical pancreatitis, strong genetic susceptibility due to SPINK1 and CFTR gene mutations and comparative phenotype of idiopathic CP suggest that the term "tropical calcific pancreatitis" is a misnomer [3]. Smoking is an independent etiological and pathogenic factor in the development of CP. Since heavy drinkers usually smoke, it is difficult to separate the effects of alcohol abuse and smoking. The effect of smoking on the progression of non-alcoholic idiopathic CP was studied in 83 patients each from Switzerland and Italy. Smoking was indeed associated with disease progression as measured by the appearance of pancreatic calcifications and, to a lesser extent, of diabetes [4]. In another Danish study, smoking both in men and women was independently associated with increased risk of pancreatitis [5]. Cessation of smoking may help slow the progression of CP [6, 7].

## Diagnosis

Pancreatic pain is heterogeneous in its manifestations and pathophysiology [8]. So, CP cannot be confirmed from symptomatology alone. Even though pancreatic biopsy is the gold standard for establishing the diagnosis, it may not be possible most of the time. Hence diagnosis must be based on some form of imaging like sonography, magnetic resonance cholangio pancreaticography (MRCP), endoscopic retrograde cholangio pancreaticography (ERCP), endoscopic ultrasonography (EUS), or computerized tomography (CT) and to look for any complications and for planning various therapeutic strategies. Early diagnosis can be made by EUS before ERCP findings are obvious [9]. Fecal elastase 1 correlates well with these tests as well as with clinical symptoms such as dyspepsia and disease history [10]. EUS guided fine needle aspiration cytology (FNAC) helps in making a diagnosis with a negative predictive value of 100 % and the specificity of 67 % [11]. EUS has become a well accepted test for the diagnosis of CP. Advantages include its ability to detect subtle and severe changes of the pancreatic duct and parenchyma, even before cross-sectional imaging, provide alternate diagnosis [13] and its relative safety compared to ERCP. Limitations include inter- and intra-observer variability, operator dependence, and an incomplete understanding of its true accuracy [12]. EUS-based diagnostic "Rosemont criteria" has been described. The major criteria for CP are (1) hyperechoic foci with shadowing and main pancreatic duct (MPD) calculi and (2) lobularity with honeycombing, and minor criteria for CP were the presence of cysts, dilated ducts ≥3.5 mm, irregular PD contour, dilated side branches ≥1 mm, hyperechoic duct wall, strands, non-shadowing hyperechoic foci, and lobularity with non-contiguous lobules. These criteria may provide a standard reference to a complex disease such as CP [14]. EUS guided fine needle cytology can differentiate CP from pancreatic ductal adenocarcinoma. However, in very early cases, where the structural changes have not taken place, there is a role of secretin test, where endoscopically directed duodenal tube is placed and the aspirate is analyzed for bicarbonate, lipase, and proteases after injection of secretin. Low enzymes and high bicarbonate are diagnostic of CP [15]. Non-invasive secretin MRCP gives almost the same result from the enhanced flow pattern [16]. CP due to genetic cause usually present at an early age.

Autoimmune pancreatitis is a relatively newly recognized entity characterized by diffuse or focal pancreatitis due to lymphoplasmacytic infiltration and fibrosis of the pancreatic parenchyma. On the basis of pancreatic imaging, together with serological measurement of IgG4 and evaluation of other organ involvement, many cases of autoimmune pancreatitis can be identified. The remaining patients might require pancreatic core needle biopsy and a therapeutic trail with steroid treatment, which can differentiate from pancreatic cancer [17].

## Treatment for CP

The therapy may be *conservative*, *endotherapy*, *ESWL*, *surgery*, and *nerve block*.

1. Conservative Therapy is as per Table 1.
2. Endoscopic Therapy

   ERCP and pancreatic stent placement are established as therapy in pseudocyst, pancreatic fistula, main pancreatic duct injury, and pancreas divisum. Same is being used as primary modality of therapy in CP for reduction of intraductal hypertension, bypass obstructing stones, restoring lumen patency in symptomatic strictures, and sealing main pancreatic duct disruption [21]. However, randomized control trials are more in favor of surgery than endotherapy [22] and suggest more durability and effectiveness with surgical therapy [23]. Significant progress has been made with new protocols of multiple stenting with improved results [24]. Endotherapy-ESWL combination is possibly better. The addition of secretin during ESWL appears to aid clearance [25] but its applicability is untested.
3. Extracorporeal Shock Wave Lithotripsy

   Endoscopic treatment associated with or without extracorporeal shock wave lithotripsy (ESWL) for CP has been employed for about 20 years. Although two randomized control trials have revealed greater effectiveness of surgery as compared to endotherapy, a considerable number of patients have successfully obtained complete and long-term relief from pain [26]. In a study of 1006 patients who underwent ESWL, complete clearance was achieved in 76 % and partial clearance in 17 %. ESWL is an effective and safe modality for fragmentation of large pancreatic duct calculi [27]. The judicious application of ESWL and ERCP in selected groups of patients has increased the success rates [28]. ESWL of obstructive pancreatic duct stones in patients with recurrent attacks can prevent further attacks. New episodes in this group of patients may indicate stone recurrence or presence of strictures [29]. Stenting of MPD after pancreatic stone extraction may reduce the risk of recurrence of symptoms [30]. Combining ERCP and ESWL for painful

**Table 1** Show the modality of conservative therapy in CP

| |
|---|
| Stop smoking and alcohol consumption [6, 8, 18, 19] |
| Low fat diet and anti-oxidants [8, 18] |
| Analgesics, NSAID's, codeine, antispasmodics, non-opiate, or low potency opiate analgesics [18] |
| Suppression of pancreatic secretion (octreotide) [18] |
| Pain modifying agents (antidepressants, gabapentin, and pregabalin) [18] |
| Pancreatic enzymes and adjunctive agents [18] |
| Zinc supplementation [20] |

pancreatic duct stones provided symptomatic improvement but there was no significant reduction in the proportion taking narcotics (50 % before vs. 44.4 % after ESWL) [31]. A Swiss study claimed that endoscopic drainage of the main pancreatic duct in addition to ESWL adds only to the costs of patient's care without improving the outcome of pain [32].

4. Surgery

It is one of the important components of therapy in the management of CP. There are multiple indications of surgery in CP (Table 2).

## Pain as Indication of Surgery

Surgery is indicated when the pain is severe, not controlled by drugs, requiring repeated hospital admission, and is interfering with day-to-day activities. One should not wait for narcotic addiction to take place. The rate of the progress of the destructive process cannot be predicted and these patients continue to have pain. However, it must be stressed that surgery for CP is not curative and does not reverse the disease process, but, is an option for pain relief. Many feel the disease process will ultimately result in "pancreatic burnout" and pain even after surgery is a possibility. Hence, one should give a serious thought about surgery for pain in CP [24]. About 70 % of the CP patients presents with pain. The origin of pain in CP is incompletely understood and is likely multi-factorial. Inflammation, increased intraductal and/or intraparenchymal pressure, pancreatic duct stenosis/dilation, and ischemia have all been implicated. It is noted that painful CP have an increased number of pancreatic mast cells as compared with those with painless CP [33]. Operations for CP can be performed with acceptable morbidity and mortality. Surgery addresses pain relief and other CP-associated complications and is an effective and durable treatment option [34].

There are many procedures for pain in CP (Table 3).

When going for drainage and/or excisional surgery, one must give consideration on the duct size, presence of any mass (inflammatory/malignant) and functional state of pancreas (Fig. 1).

**Table 2** Indications of surgery in CP

| |
|---|
| Pain |
| Mechanical obstruction |
| CBD, duodenum, splenic and portal vein, and colon |
| Pancreatic complications |
| Pseudocyst, pancreatic fistula, pancreatic ascitis, pancreatic pleural effusion, and bleeding |
| Malignancy |

**Table 3** Surgical procedures described for pain

1. Drainage procedures
   - (a) Duval procedure
   - (b) Puestow and Gillispie
   - (c) Partington and Rochelle[a]
2. Resection procedures
   - (a) Distal pancreatectomy with or without splenectomy
   - (b) Subtotal pancreatectomy
   - (c) Duodenum preserving pancreatectomy
   - (d) Kausch–Whipple pancreatoduodenectomy
   - (e) Pylorus preserving pancreatoduodenectomy
3. Drainage and resection procedures
   - (a) Beger's head excision and drainage[a]
   - (b) Frey's head coring and drainage[a]
   - (c) Others: Berne procedure and Izbicki operation
4. Denervation procedures
   - (a) Splanchnicectomy
   - (b) Coeliac ganglionectomy
   - (c) Denervated pancreatic flap surgery

[a] Commonly done procedures at present

The aim of the surgery should be to:

1. Preserve maximum functional pancreatic tissue.
2. Remove the inflammatory mass.
3. Good drainage of the ductal system.
4. Not obstructing the side ducts.

To achieve the above principles, a combination of drainage and resectional procedure is used.

The evolution of pancreatic surgery and the common surgical procedures with their advantages and limitations are described in Table 3 and Fig. 2.

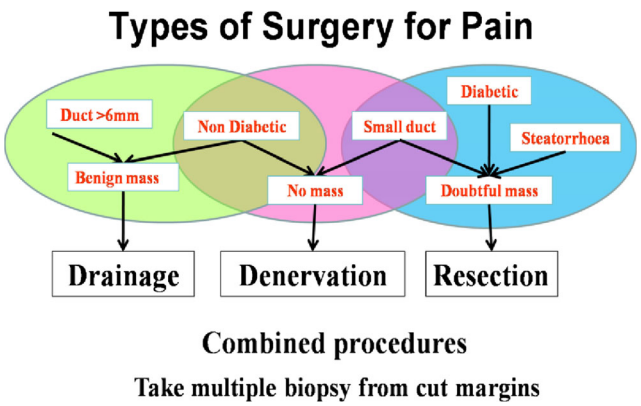
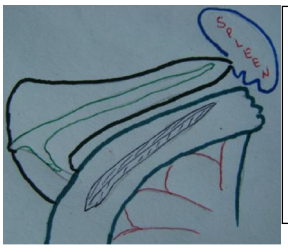



**Fig. 1** Recommendation of surgical procedures in various clinical settings

Partington & Rochelle (1960)



| Advantages | Disadvantages |
|---|---|
| - Good drainage of duct<br>- All ductal stones removed<br>- No loss of pancreatic tissue | - Inflammatory mass if present is still left over<br>**Present status** -<br>**Still a good procedure with dilated duct and no inflammatory mass** |

Duodenum-preserving pancreatic head resection

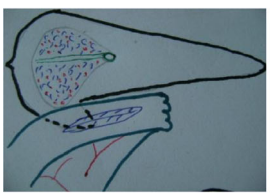
(DPPHR, Beger procedure)

| Advantages | Disadvantages |
|---|---|
| - Remove the painful head mass<br>- Doubt of malignancy is confirmed/ruled out<br>Duodenum preserved<br>Present status - Rarely done | Distal duct is not opened. Hence inadequate drainage<br>Distal ductal stone left over<br>Loss of pancreatic tissue<br>Too big a procedure for a benign condition<br>Present status - Rarely done |

DPPHR modification: Frey procedure (limited local resection of the pancreatic head combined with drainage of the main pancreatic duct).

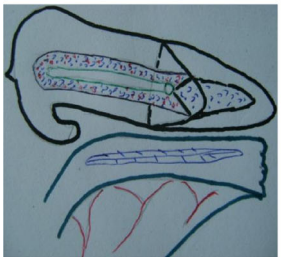
| Advantages— | Disadvantages- Body and tail inflammatory mass not addressed. |
|---|---|
| Remove the painful head mass<br>- Doubt of malignancy is confirmed/ ruled out<br>Whole duct is opened and all the stones removed<br>Duodenum preserved - Better drainage | Present status- **Possibly the best surgery for pain in CP** |

PPHR modification: Berne procedure(limited local resection of the pancreatic head)



| Advantages | Disadvantages - |
|---|---|
| - Remove the painful head mass<br>Doubt of malignancy is confirmed / ruled out<br>- Duodenum preserved<br>Present status - **Selectively done.** | Distal duct is not opened. Inadequate drainage<br>Distal ductal stone left over<br>Loss of pancreatic tissue<br>**Present status - Selectively done.** |

Longitudinal V-shaped excision (Izbicki operation)



| | |
|---|---|
| Advantages | - Whole duct is opened |
| Disadvantages | - Cone of functional pancreatic tissue loss |
| **Present status** | **- Possibly the best surgery for pain with an inflammatory mass at the head of pancreas.** |

**Fig. 2** Showing advantages and disadvantages of commonly done surgical procedures

## Present Status of Surgical Procedures

### *Drainage Procedures*

In CP, pain is the most frequent indication for surgery [35]. Patients should be referred for surgery before opiates are needed [36]. Resection and drainage are the two basic principles in surgical treatment [37]. Long-term pain relief at 6.4 to 9 years is significant after Frey's procedure [1, 37, 38]. Excision of pancreatic tissue and the dissection of SMV and portal vein and transection of pancreas are the disadvantages of Beger's procedure [38] (Fig. 2). Pancreaticoduodenectomy (PD) and the duodenum-preserving pancreatic head resection (DPPHR) are found to be safe and effective techniques resulting in long-lasting pain relief in about 80 % of patients in randomized control trials. There are initial functional advantages for the organ-preserving DPPHR compared to PD, but these advantages are lost during follow-up, most likely because neither operation prevents a progressive loss of exocrine and endocrine functions. Nevertheless, the less invasive DPPHR should be regarded as the procedure of choice. The technique of DPPHR described by Beger was modified by Frey to an extended drainage procedure with local head excision. The Berne modification offers a technically less demanding option with comparable extent of resection. While results in terms of pain relief, quality of life, and organ function are comparable between the three DPPHR techniques, the technical aspect of a simpler procedure favors the Berne modification [39] (Sketches in Fig. 2).

A pancreatic duct diameter (PDD) ranging from 4 to 5 mm is regarded as "normal". The "large duct" form of CP with a PDD>7 mm is considered a classical indication for drainage procedures. In contrast, in patients with so-called "small duct pancreatitis" (SDP) with a PDD<3 mm, extended resectional procedures are suggested including even total pancreatectomy. "V-shaped excision" of the anterior aspect of the pancreas is a secure and effective approach for SDP, achieving significant improvement in quality of life and pain relief. The deterioration of exocrine and endocrine pancreatic functions is comparable with that observed during the natural course of the disease [39]. While sparing patients from unnecessary, extended resectional procedures, it appears not to result in substantial deterioration of exocrine and endocrine pancreatic function [40]. With inflammatory pancreatic head mass and stenosis of the distal bile duct, extended drainage procedures with limited pancreatic head resection according to Frey and V-shaped excision of the ventral aspect of the pancreas have been performed successfully [35]. Local resection or excavation of the pancreatic head offers the advantage of lowest cost and morbidity and early prevention of postoperative diabetes. The late incidences of recurrent pain, diabetes, and exocrine insufficiency are equivalent for drainage, denervation, and resection approaches. Local resection of the pancreatic head appears to offer best outcomes and lowest risk for the management of the pain of CP [41]. In patients with CP refractory to conservative medical treatment, surgery rather than endotherapy is the standard of care. Parenchyma-preserving resections should preferably be performed because they ensure lower morbidity and mortality, preserve endocrine function, and improve quality of life [42]. In a randomized controlled trial, the Berne technique was found to be technically simpler compared with the original Beger's procedure, reflected in significantly shorter operation times and hospital stays. The quality of life is similar after both procedures [43].

### *Resection Procedures*

Various excisional procedures (Table 3) are done for patients in severe pain. The procedure of choice is decided based on Fig. 1. However, a longitudinal V-shaped excision of the ventral pancreas combines extensive drainage and a limited resection and offers good pain relief in diffuse small duct CP. However, long-term results and larger series are awaited for definite conclusions [44]. Whipple's procedure is advised with a head mass where cancer cannot be ruled out. Total pancreatectomy can ameliorate pain and improves quality of life in refractory CP patients, but the diabetes becomes very brittle. Islet autotransplantation is one solution in such situations. It preserves meaningful islet function in most patients and substantial islet function in more than two thirds of patients, with insulin independence occurring in one quarter of adults and half the children [45, 46].

### *Drainage and Resection*

Four of these procedures are given in Table 3 and Fig. 2.

### *Denervation Procedures*

(i) Celiac Ganglionectomy

Image-guided celiac plexus block is the choice over open surgery. In a meta-analysis, EUS-guided celiac neurolysis was noted to provide pain relief in 50–60 % of patients. Better techniques or injected materials are needed to improve the response [47].

(ii) Splanchnicectomy

Thoracoscopic splanchnicectomy is an alternative to celiac plexus block. This procedure is similar to percutaneous block with a higher degree of precision and avoids the side effects associated with the local diffusion of neurolytic solutions [48]. The relief of pain is not durable in most cases [49]. Bilateral posterior thoracoscopic splanchnicectomy approach with the patient in a face-down position reduces operation time [50].

(iii) Denervated Pancreatic Flap Surgery
Outdated procedure was described by Shires GT(1986) for small duct CP and non-diabetic patient.

COMPLICATIONS OF CP—It can be pancreatic and peripancreatic.

Pancreatic Complication

*Pseudocyst*

Pancreatic pseudocysts are complications of AP, CP, and pancreatic trauma. Most pseudocysts resolve spontaneously with supportive care. The size and the long duration of the cyst are poor predictors for the potential of pseudocyst resolution or complications. The main indications for some type of invasive drainage procedure are persistent symptoms or the presence of complications (infection, gastric outlet or biliary obstruction, and bleeding). Three different strategies for pancreatic pseudocyst drainage are available: endoscopic (transpapillary or transmural) drainage, percutaneous catheter drainage, or open surgery. To date, no prospective controlled studies have compared these approaches. As a result, management varies based on local expertise, but in general, endoscopic drainage is becoming the preferred approach because it is less invasive, avoids the need for external drain and has a high long-term success rate. A tailored therapeutic approach taking into consideration patient preferences and involving multidisciplinary team of therapeutic endoscopist, interventional radiologist, and pancreatic surgeon should be considered in all cases [51, 52]. Pancreatic pseudocysts are often associated with various complications, e.g., various organ involvements, infection, hemorrhage with pseudoaneurysm formation, and rupture with fistula formation or gastrointestinal or biliary obstruction, which may necessitate prompt intervention or surgery. Cystoenteric communication can be done with stomach and duodenum, when the pseudocyst is adherent to the organ or else a Roux-en-Y cysto-jejunal anastomosis is preferred. Persistent moderate size cyst with doubt of mucinous cystadenoma, EUS-guided ethanol ablation has shown a durable, image-defined resolution. Longer follow-up in these patients is needed before considering these patients "cured" of their disease [53]. EUS-guided ethanol lavage results in a greater decrease in pseudocyst size compared with saline lavage with a similar safety profile. Overall, CT-defined complete ablation was 33.3 % [54].

*Bleeding in CP*

Bleeding in CP may be into the peritoneal cavity, into pancreatic duct leading to hemosuccus pancreaticus, into the pseudocyst, or into the GI tract due to pseudoaneurysm. Visceral pseudoaneurysms occur in approximately 4–10 % patients with CP and in untreated cases the mortality can reach up to 90 % [55]. Hemosuccus pancreaticus is rare, but should be considered in patients with CP and gastrointestinal bleeding. In a review of patients with hemosuccus pancreaticus, CP was the cause in 76.5 % of the 64 cases documented [56]. In the absence of pancreatitis-related indications for surgery, angiographic embolization can be definitive treatment (Fig. 3). If there are pancreatitis-related indications for operation, angiographic embolization may allow an elective operative procedure. If embolization fails, pancreatic resection is usually required on an emergent basis.

*Pancreatic Fistula and Effusion*

An all-inclusive definition is a drain output of any measurable volume of fluid on or after postoperative Day 3 with amylase content greater than three times the serum amylase activity [57]. It is usually a complication of acute and CP but can also occur postoperatively or after abdominal trauma. Commonly occurs after external drainage of pseudocyst. Conservative treatment of pancreatic fistula is time-consuming and often fails. Endoscopic treatment has become the preferred first-line treatment in many centers [58, 59]. Surgery is necessary in few cases when endoscopy fails or is not technically feasible [60]. Pancreatic-pleural or pancreatic-mediastinal fistula is a rare complication of pancreatitis associated with unilateral pleural effusion. Combined internal endoscopic drainage and external chest drainage are the treatment of choice. After failure of routine endoscopic therapy, endoscopic closure of fistulas using fibrin glue might offer an alternative treatment strategy [61].

*Pancreatic Ascites*

Pancreatic ascites is due to the leak from the pancreatic duct or from the pseudocyst. Leak can be detected early once it is


**Fig. 3** Angiogram showing bleeding pseudo-aneurism in a replaced hepatic artery

suspected by raised serum amylase and gross elevation of ascitic fluid amylase. Prompt and definitive surgical management is recommended for this potentially lethal condition [62]. Endoscopic therapy offers an excellent therapeutic alternative in patients with pancreatic ascites and pleural effusion [59, 63].

*Adenocarcinoma in CP*

The incidence of pancreatic cancer is around 5 % over a 20-year period; hence the development of more sophisticated screening procedures is required before screening is recommended for patients with CP [64]. Pancreatic malignancy in the presence of CP needs appropriate surgical excision. Pancreatic malignancy should be suspected in patients who have recurrence of symptoms (recurrent pain, jaundice, weight loss, or anorexia) after surgery for CP. Attempts at curative pancreatic resection can offer the potential for a cure/best palliation. CA 19–9 remains the tumor marker against which new markers for this malignancy are judged [65]. There are two tumor markers identified: laminin gamma C2 (LAMC2), which is a serum biomarker positive in 65 % of cases [66], and CA-242, which could play different roles in diagnosis of pancreatic cancer. Though the sensitivity of CA-242 is lower than that of CA19-9, its specificity is greater [67]. Elevated serum bilirubin and CA 19–9, dilated MPD and common bile duct (CBD) are useful in predicting malignancy in patients with CP and head mass [68]. Owing to the poor prognosis in untreated pancreatic cancer, the general recommendation is to perform resection of the tumor when technically possible or when carcinoma cannot be ruled out [69].

Peripancreatic Complication

*Bile Duct Obstruction*

The incidence of biliary stricture (BS) is reported to be about 6 % [70]. BSs are common in advanced CP and have a variable clinical presentation ranging from an incidental finding to overt jaundice and cholangitis [71]. Benign BS in patients with CP may lead to secondary biliary cirrhosis or recurrent cholangitis [71–73]. A twofold elevation of alkaline phosphatase is a marker of possible common duct stenosis. Cholangiogram reveals a characteristic long, smoothly tapered stricture of the intra-pancreatic bile duct [70] (Fig. 4). Initial conservative treatment is advised in patients who present with jaundice as most will resolve once the acute on chronic attack has subsided [71]. Resolution with steroids is complete in autoimmune pancreatitis, and they do not require surgery [74, 75]. Endoscopic drainage of biliary obstruction by self-expandable metal stents provides excellent long-term results [76, 77]. However, the high incidence of late complications in non-compliant patients is a limitation of biliary stenting and


**Fig. 4** Typical cholangiogram in case of CP with narrowing of intra-pancreatic part of the common duct

appears to be potentially harmful [78]. The use of metal endoprostheses may result in occlusion, necessitating open operation [24]. There are high relapse rates and requirement for multiple ERCP sessions. Significant progress has recently been made with new protocols of multiple simultaneous plastic stents or covered metallic stents [79].

Surgery is indicated in patients with BS secondary to CP when there is evidence of cholangitis, biliary cirrhosis, common duct stones, progression of stricture, elevation of alkaline phophatase, and/or bilirubin for over a month and an inability to rule out cancer. The operation of choice is either choledochoduodenostomy or choledochojejunostomy. A cholecystoenterostomy is less favored because of its higher

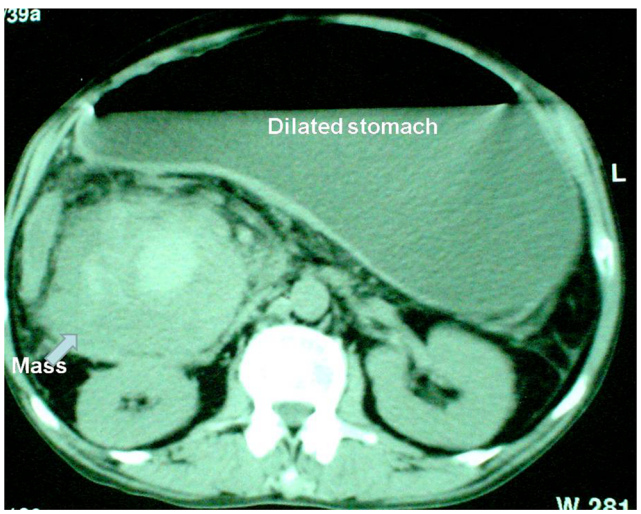



**Fig. 5** Pancreatic inflammatory head mass causing duodenal obstruction

failure rate (23 %). Endoscopic stenting plays a role in patients who are unfit for surgery [70]. Biliary drainage may be combined with a pancreaticojejunostomy [71, 73], in patients who have associated pain. Since many patients with CP have an inflammatory head mass, a Frey procedure is indicated but a formal resection should be performed when there is concern about a malignancy. Temporary endoscopic stenting is reserved for cholangitis while an expandable metal stent may be indicated in patients with severe comorbid disease [71]. Reinsertion of the distal CBD into the pancreatic resection cavity during duodenum-preserving pancreatic head excision (DPPHE) may be an alternative option to Whipple resection or bilioenteric anastomosis when CP is associated with CBD stenosis [79].

### *Duodenal Obstruction*

The incidence of duodenal obstruction is reported to be about 1.2 %. It may be due to a head inflammatory mass (Fig. 5) and later due to ischemia, a pseudocyst, groove pancreatitis, or fibrosis [80]. These patients present with a prolonged history of vomiting and barium studies typically show a long constricting lesion of the duodenum, and endoscopy reveals reactive inflammatory changes in a narrowed duodenum. For duodenal obstruction, failure to resolve the obstruction with 1–2 weeks of conservative therapy is an indication for bypass. The operation of choice is a gastrojejunostomy. Not uncommonly, combined obstruction of the pancreatic duct, common bile duct, and duodenum will develop. Combined drainage procedures or resection are used to manage these problems [80]. Duodenal obstruction may be associated with other complications such as sinistral portal hypertension, biliary obstruction, and endocrine as well as exocrine deficiency [81] (Figs. 1 and 2).

### *Venous Thrombosis*

The most common cause of isolated splenic vein thrombosis (SVT) is CP caused by perivenous inflammation. The mean incidence is 14.1 % in all patients, 22.6 % in patients with AP and 12.4 % in patients with CP [82]. Although SVT has been reported in up to 22–45 % of patients with CP, most patients remain asymptomatic [83, 84]. Gastric variceal bleeding from pancreatitis-induced SVT occurs in only 4 % of patients; therefore, routine splenectomy is not recommended [85, 86]. In those patients with gastrointestinal bleeding secondary to esophageal or gastric varices, the diagnostic test of choice to assess for the presence of SVT is late-phase celiac angiography. Splenectomy effectively eliminates the collateral outflow and is the treatment of choice. Other underlying pathology, such as pseudocysts, can be treated at the same time [83, 84].

### Colonic Complications

The presentation, management, and outcome of colonic complications differ in chronic and AP. In CP, pancreatocolonic fistula predominated and could be managed either with local excision or segmental resection of the colon with excellent results [87]. Colonic stricture is also a known rare complication in CP [87] needs a segmental resection.

### Exocrine Deficiency and Endocrine Deficiency

### *Steatorrhoea*

As per randomized cross-over trials, pancreatic enzyme supplements appear to improve fat malabsorption [88]. It may not abolish steatorrhoea but improves coefficient of fat absorption [89]. Proton pump inhibitor improves it further.

### *Pancreatogenic Diabetes*

The prevalence of diabetes mellitus (DM) among patients with an established CP is reported to be up to 70 % (90 % in CCP) [90] DM secondary to pancreatic diseases is commonly referred to as pancreatogenic diabetes or type 3c DM. The course of the disease is complicated by additional comorbidities such as maldigestion and concomitant qualitative malnutrition. In patients with type 3c DM treating exocrine pancreatic insufficiency, preventing or treating a lack of fat-soluble vitamins (especially vitamin D) and restoring impaired fat hydrolysis and incretin secretion are key features of medical therapy [91].

*Summary and Conclusion* The two main etiological groups of chronic pancreatitis namely alcohol + smoking and genetic getting clearer, where the later group present at early age. Endoscopic ultrasound and imaging with secretin is diagnostic of chronic pancreatitis before the structural changes. Endotherapy is found to be inferior to surgery in long-term pain relief. A diagnostic criterion for autoimmune pancreatitis is established. Pancreaticogenic diabetes (Type3c) and its problem associated with fat and fat soluble vitamins malabsorption are being understood.

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