



INDICATIONS OF SURGICAL PROCEDURES AND THEIR OUTCOMES IN PATIENTS WITH CHRONIC PANCREATITIS - A PROSPECTIVE OBSERVATIONAL STUDY IN A TERTIARY CARE CENTRE IN CENTRAL INDIA

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ABSTRACT

Introduction: Chronic pancreatitis is a complex and debilitating disease associated with significant morbidity and reduced quality of life. In many patients, surgery is performed after prolonged periods of medical or endoscopic treatment, which may lead to advanced pancreatic damage and poorer outcomes. Additionally, the choice of surgical procedure often depends on individual patient characteristics and disease patterns, making it important to evaluate the effectiveness of different surgical approaches. This study aims to access the indications and outcomes of surgical interventions in patients with chronic pancreatitis.

Methods and Materials: A prospective observational study of 80 adult patients, undergoing surgical procedures for chronic pancreatitis, was performed in Department of General Surgery of Government Medical College and Hospital, Nagpur for a period of 18 months (From December 2024 to June 2026).

Results: The majority of patients were males (77.5%), with the highest proportion belonging to the 31–40 years age group (27.5%). Most patients originated from rural areas (65.0%). Alcohol consumption and smoking were identified as major risk factors, being present in 70.0% and 60.0% of patients, respectively. Abdominal pain was the universal presenting symptom occurring in all patients (100%). Preoperative endocrine and exocrine dysfunction were observed in 30.0% and 32.5% of patients, respectively. Pancreatic ductal dilatation as the most common radiological finding (72.5%), followed by pancreatic calcifications (62.5%). Intraoperatively, dilated main pancreatic duct (70.0%), dense peripancreatic adhesions (57.5%) and pancreatic calcifications (52.5%) were the predominant findings. The most common indication for surgical intervention was intractable abdominal pain (42.5%), followed by pancreatic ductal obstruction (20.0%). Frey procedure was the most frequently utilized operation (37.5%), followed by lateral pancreaticojejunostomy (27.5%). Complete pain relief was achieved in 60.0% of patients, while an additional 27.5% experienced partial relief, resulting in

an overall pain improvement rate of 87.5%. Postoperative complications occurred in 50.0% of patients, with surgical site infection (15.0%) being the most common complication. The majority of patients (45.0%) had a postoperative hospital stay of 8–14 days, and postoperative mortality was low at 2.5%. Postoperatively, new-onset or worsened endocrine and exocrine dysfunction occurred in 12.5% and 15% patients.

Drainage procedures produced superior outcomes. Cyst drainage procedures showed the highest rate of complete pain relief (75.0%) and the lowest complication rate (25.0%), followed by lateral pancreaticojejunostomy, which achieved complete pain relief in 63.6% of patients with a complication rate of 40.9%. Patients undergoing early surgery demonstrated significantly better outcomes than those undergoing delayed surgery in terms of complete pain relief, postoperative complications, and prolonged hospital stay.

Conclusion: Chronic pancreatitis requiring surgery predominantly affects middle-aged males with significant exposure to risk factors such as alcohol consumption and smoking. Abdominal pain was identified as the universal and most significant clinical feature, reinforcing its central role as the primary indication for surgical intervention. Organ-preserving and drainage procedures, particularly the Frey procedure and lateral pancreaticojejunostomy, constitute the mainstay of surgical treatment and are associated with favorable outcomes with complete pain relief, acceptable complication rates and effectively preserving pancreatic function in the majority of patients. Early surgery was significantly associated with superior pain relief, lower complication rates, and shorter hospital stay. These findings strongly support a shift toward earlier surgical management in appropriately selected patients, rather than prolonged conservative or endoscopic treatment in the face of persistent symptoms.

KEYWORDS: Chronic Pancreatitis, Drainage Procedures, Longitudinal Pancreaticojejunostomy, Frey procedure, Resection Procedures.

Introduction

Chronic pancreatitis (CP) is a progressive inflammatory disorder of the pancreas characterized by irreversible morphological changes, fibrosis, and gradual loss of both exocrine and endocrine pancreatic function. The disease leads to structural damage of the pancreatic parenchyma and ductal system, resulting in chronic abdominal pain, malabsorption due to pancreatic exocrine insufficiency, and diabetes mellitus due to endocrine dysfunction. Chronic pancreatitis is considered a complex and multifactorial disease with significant clinical morbidity and long-term complications affecting patient quality of life[1]. The hallmark pathological features of chronic pancreatitis include progressive pancreatic fibrosis, parenchymal atrophy, calcification, and irregular dilatation of the pancreatic duct. These structural changes lead to obstruction of pancreatic ducts and subsequent increase in intraductal pressure, which contributes significantly to the characteristic abdominal pain experienced by patients[2]. Chronic pancreatitis is associated with a wide spectrum of clinical manifestations ranging from mild intermittent abdominal pain to severe debilitating disease with pancreatic insufficiency and life-threatening complications. The disease is not only associated with physical morbidity but also leads to significant psychological, nutritional, and socioeconomic burden due to recurrent hospital admissions during most productive years of life, reduce quality of life and chronic disability[3].

Several classification systems have been proposed to categorize the various causes of chronic pancreatitis. One widely accepted classification is the TIGAR-O classification, which categorizes etiological factors into toxic-metabolic, idiopathic, genetic, autoimmune, recurrent acute pancreatitis, and obstructive causes[4]. Alcohol consumption remains

the most common etiological factor for chronic pancreatitis worldwide, accounting for approximately 60–70% of cases in many studies. Chronic alcohol intake leads to direct toxic effects on pancreatic acinar cells and stimulates the secretion of protein-rich pancreatic juice that promotes the formation of protein plugs within pancreatic ducts. Over time, these plugs calcify and obstruct the ductal system, leading to chronic inflammation and fibrosis[5]. Over the past few decades, there has been an increasing recognition of the role of genetic factors in the development of chronic pancreatitis. Mutations in genes such as PRSS1, SPINK1, CFTR, and CTSC have been implicated in hereditary and idiopathic forms of chronic pancreatitis[6]. These mutations alter the control of activation of pancreatic enzyme making individuals susceptible to recurrent pancreatitis. Obstruction of the pancreatic duct due to strictures, tumors, or congenital anomalies such as pancreas divisum can lead to increased intraductal pressure and chronic inflammation of the pancreas. Obstructive pancreatitis often results in segmental pancreatic damage and progressive fibrosis[7]. Autoimmune pancreatitis is a distinct form of chronic pancreatitis characterized by lymphoplasmacytic infiltration of pancreatic tissue and elevated serum IgG4 levels. It is often associated with other autoimmune disorders and typically responds well to steroid therapy[8,9].

One of the key mechanisms involved in the pathogenesis of chronic pancreatitis is the premature activation of pancreatic enzymes within the pancreas, leading to autodigestion of pancreatic tissue. Activated enzymes cause acinar cell injury, which triggers inflammatory responses and recruitment of immune cells[10]. Repeated episodes of pancreatic inflammation stimulate the activation of pancreatic stellate cells, which play a central role in the

development of pancreatic fibrosis. These stellate cells produce extracellular matrix proteins that lead to progressive scarring and destruction of pancreatic tissue[11]. As fibrosis progresses, the pancreatic ductal system becomes distorted and obstructed. This results in increased intraductal pressure and further damage to pancreatic parenchyma. Over time, the pancreatic gland undergoes atrophy and loss of functional tissue, leading to exocrine and endocrine insufficiency[12]. Chronic inflammation also affects pancreatic nerves, leading to neuropathic changes that contribute significantly to chronic abdominal pain. Neural inflammation, hypertrophy, and increased nerve density have been observed in patients with chronic pancreatitis and are believed to play a role in pain generation[13].

Chronic pancreatitis is a relatively uncommon but clinically significant disease. The incidence and prevalence of chronic pancreatitis vary geographically and are influenced by environmental factors, alcohol consumption patterns, genetic predisposition, and socioeconomic conditions. In Western countries, the incidence of chronic pancreatitis is estimated to be between 5 and 12 cases per 100,000 population per year, while the prevalence ranges from 25 to 50 cases per 100,000 population[14]. In Asian countries, including India, the epidemiology of chronic pancreatitis shows distinctive characteristics. A unique form of the disease known as tropical chronic pancreatitis has been described predominantly in tropical regions. This variant often affects younger individuals and is associated with early development of pancreatic calcifications and diabetes mellitus[15].

The clinical presentation of chronic pancreatitis varies depending on the stage and severity of the disease. The most common symptom is chronic abdominal pain, typically located in the epigastric region and often radiating to the back. The pain may be intermittent or continuous and is frequently aggravated by meals[16]. Other symptoms include nausea, vomiting, weight loss, and steatorrhea due to pancreatic exocrine insufficiency. As the disease progresses, many patients develop diabetes mellitus, also known as pancreatogenic or type 3c diabetes[17]. Complications of chronic pancreatitis include pseudocyst formation, biliary obstruction, duodenal obstruction, pancreatic ascites, splenic vein thrombosis, and increased risk of pancreatic cancer[18]. The diagnosis of chronic pancreatitis is based on a combination of clinical features, imaging studies, and laboratory findings. Imaging modalities such as ultrasonography, computed tomography (CT), magnetic resonance cholangiopancreatography (MRCP), and endoscopic ultrasonography (EUS) play a crucial role in confirming the diagnosis and assessing disease severity. Typical imaging findings include pancreatic calcifications, ductal dilatation, glandular atrophy, and pseudocysts. CT scan remains one of the most widely used imaging techniques for evaluating structural changes in the pancreas[19].

Management of chronic pancreatitis is aimed at relieving pain, managing complications, and improving pancreatic function. Treatment options include medical therapy, endoscopic interventions, and surgical management. Medical treatment focuses on pain control, pancreatic enzyme supplementation, and management of diabetes mellitus. Endoscopic interventions are used to treat ductal strictures, remove pancreatic stones, and drain pseudocysts[20]. However, many patients eventually require surgical intervention due to persistent symptoms or complications that cannot be adequately managed by medical or endoscopic therapy. Surgery plays a crucial role in the management of chronic pancreatitis, particularly in patients with intractable pain, ductal obstruction, inflammatory masses, or complications. Surgical procedures aim to relieve ductal obstruction, reduce intrapancreatic pressure, and remove diseased pancreatic tissue. Common surgical procedures for chronic pancreatitis include drainage procedures, resection procedures, and combined procedures. Drainage procedures such as longitudinal pancreaticojejunostomy are typically performed in patients with dilated pancreatic ducts. Resection procedures such as pancreaticoduodenectomy or distal pancreatectomy are performed when there is localized disease or suspicion of malignancy[21]. Combined procedures such as the Frey procedure and Beger procedure address both ductal decompression and resection of inflammatory masses in the pancreatic head. These procedures have shown favorable outcomes in terms of pain relief and preservation of pancreatic function[22]. Surgical management has been shown to provide superior long-term pain relief compared to endoscopic therapy in selected patients, particularly when performed at an appropriate stage of the disease[23]. The outcomes of surgical treatment in chronic pancreatitis include improvement in pain, quality of life, nutritional status, and pancreatic function. Studies have reported pain relief in approximately 70–90% of patients following surgical intervention[24]. However, surgery is associated with potential complications such as pancreatic fistula, delayed gastric emptying, postoperative bleeding, and infection. Long-term outcomes also depend on factors such as disease severity, surgical technique, and timing of surgery. Recent studies have suggested that early surgical intervention may lead to better outcomes compared to delayed surgery, particularly in terms of pain relief and preservation of pancreatic function[25].

Justification of the Study

Chronic pancreatitis is a complex and debilitating disease associated with significant morbidity and reduced quality of life. Although various surgical procedures are available for the management of chronic pancreatitis, the indications for surgery and the outcomes associated with different surgical techniques remain areas of ongoing research and debate. In many patients, surgery is performed after prolonged periods of medical or endoscopic treatment, which may lead to advanced pancreatic damage and poorer outcomes.

Additionally, the choice of surgical procedure often depends on individual patient characteristics and disease patterns, making it important to evaluate the effectiveness of different surgical approaches. Despite advances in surgical techniques, there is limited prospective data from tertiary care centers in India evaluating the indications for surgical procedures and their outcomes in patients with chronic pancreatitis.

Aims and Objectives

- To assess the indications of surgical interventions in patients with chronic pancreatitis.
- To assess the outcomes of surgical interventions in patients with chronic pancreatitis.
- To compare symptom relief (pain, exocrine and endocrine dysfunction) across different surgical procedures used in chronic pancreatitis.
- To analyze the correlation between timing of surgery (early vs delayed) and postoperative quality of life or complication profile.

Materials and Methods

A prospective observational study was performed in Department of General Surgery of Government Medical College and Hospital, Nagpur for a period of 18 months (From December 2024 to June 2026) during which eligible patients undergoing surgical procedures for chronic pancreatitis were included and followed up for postoperative outcomes for 6 months.

Study Population

All adult patients diagnosed with chronic pancreatitis who underwent surgical intervention during the study period. All eligible patients, who satisfied the inclusion criteria and consented to participate in the study, were included.

Inclusion Criteria

The study included patients of either sex, aged 18 years or more, diagnosed with chronic pancreatitis based on clinical presentation, radiological evidence with supportive biochemical investigations and undergoing surgical intervention for chronic pancreatitis and patients willing to participate in the study and signed written informed consent form and available for postoperative follow-up for 6 months.

Exclusion Criteria

All patients under 18 years of age, or patients with acute pancreatitis without features of chronic pancreatitis or patients with pancreatic malignancy diagnosed preoperatively, or patients who were managed conservatively or with endoscopic treatment alone without surgical intervention, or patients who refused to provide consent for participation in the study, or patients who were medically unfit for surgery.

Withdrawal Criteria

Participants were withdrawn from the study if they chose to withdraw their consent at any stage during the study period.

Patients who were lost to follow-up before completion of the postoperative observation period or those in whom intraoperative findings revealed pancreatic malignancy or those with incomplete clinical data that prevented proper evaluation of study outcomes were excluded from the final analysis. Withdrawal of patients from the study did not affect the standard of medical or surgical care provided to them.

Sample Size

Applying the standard formula for single proportion studies, $n = Z^2 \cdot 1-a/2P(1-P)/d^2$, where P(proportion of patients achieving successful pain relief - primary outcome) = 75% [23] and d(Absolute precision required on either side of the proportion) = 10% and Z = 1.96 for 95% confidence interval.

Thus, a minimum sample size was calculated to be 72 patients. However, to account for potential dropouts or incomplete follow-up, we adjusted the sample size by an additional 10% the final sample size was 80 patients.

Sampling Technique

In this study, consecutive sampling technique was used for the recruitment of participants. This method ensured that all eligible patients presenting during the study period were included without any selection bias.

Ethics

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Prior approval for the study was obtained by the Institutional Ethics Committee (IEC) and written informed consent was obtained from the patients prior to study initiation. Participation in the study was completely voluntary, and patients had the right to withdraw from the study at any time without affecting their treatment. Confidentiality of patient information was strictly maintained throughout the study. The study did not involve any experimental interventions, and all patients received standard treatment as per institutional protocols.

Study Procedure

All patients presenting to the Department of General Surgery with clinical suspicion or diagnosis of chronic pancreatitis during the study period were evaluated in detail. Patients who fulfilled the inclusion criteria were recruited into the study after obtaining written informed consent. A detailed clinical history was obtained from each patient, including demographic details along with relevant clinical information such as duration of symptoms, nature and severity of abdominal pain, history of alcohol consumption, smoking history, previous episodes of pancreatitis, history of diabetes mellitus, and any previous medical or endoscopic interventions. A thorough physical examination was performed for each patient with particular attention to abdominal findings, nutritional status, and evidence of complications associated with chronic pancreatitis. All enrolled patients underwent routine laboratory investigations

as part of the standard preoperative workup. Imaging studies were performed to confirm the diagnosis and assess the extent of pancreatic disease. Radiological investigations included abdominal ultrasonography in all patients, followed by contrast-enhanced computed tomography (CECT) of the abdomen, magnetic resonance cholangiopancreatography (MRCP), or endoscopic ultrasonography (EUS) when required. These imaging modalities were used to evaluate pancreatic ductal dilatation, pancreatic calcifications, inflammatory mass in the pancreatic head, pseudocysts, biliary obstruction, and other complications associated with chronic pancreatitis. Based on the clinical presentation, imaging findings, and response to previous medical or endoscopic therapy, patients were evaluated for surgical management. The indication for surgery was determined by the treating surgical team according to established clinical guidelines. Preoperative assessment was performed in all indicated patients to evaluate their fitness for surgery. This included a detailed anesthetic evaluation and necessary preoperative investigations such as electrocardiography, chest radiography, and additional tests depending on patient comorbidities. Appropriate preoperative optimization was carried out, including correction of electrolyte imbalances, nutritional support when required, and control of blood glucose levels in diabetic patients. The type of surgical procedure performed was determined based on the underlying pathology, pancreatic ductal anatomy, and intraoperative findings. Drainage procedures such as longitudinal pancreaticojejunostomy were performed in patients with a dilated pancreatic duct without a significant inflammatory mass in the pancreatic head. In patients with an inflammatory mass in the pancreatic head associated with ductal dilatation, combined drainage and resection procedures such as the Frey procedure or Beger procedure were performed when indicated. Resection procedures such as pancreaticoduodenectomy or distal pancreatectomy were performed in selected patients depending on the location of the disease and the presence of complications or suspicion of malignancy. All surgical procedures were performed under general anesthesia using standard operative techniques. Intraoperative findings were carefully documented, including the size and appearance of the pancreas, presence of ductal dilatation, pancreatic calcifications, inflammatory mass in the pancreatic head, pseudocysts, and involvement of adjacent structures. The type of surgical procedure performed, operative duration, intraoperative blood loss, and any intraoperative complications were recorded. Following surgery, all patients were monitored in the postoperative ward or intensive care unit depending on their clinical condition. Postoperative management included monitoring of vital parameters, fluid balance, pain control, nutritional support, early detection of complications and regular laboratory investigations. Any postoperative complications such as pancreatic fistula, hemorrhage,

wound infection, delayed gastric emptying, or respiratory complications were documented. Patients were followed up during their hospital stay and subsequently during outpatient visits after discharge for 6 months. Follow-up evaluation included assessment of pain relief, improvement in symptoms, development of endocrine (development of diabetes mellitus or worsening glycemic control) or exocrine (steatorrhea or requirement for pancreatic enzyme supplementation) pancreatic insufficiency, and occurrence of any postoperative complications. All relevant clinical information, operative details, and postoperative outcomes were recorded systematically in a structured case record form designed specifically for the study.

Outcome Measures

The outcomes of the study were categorized into primary and secondary outcomes. The primary outcome measure was the evaluation of indications for surgical procedures in patients with chronic pancreatitis and the effectiveness of these surgical procedures in relieving symptoms, particularly abdominal pain. Pain relief following surgery was assessed based on the reduction or complete disappearance of abdominal pain as reported by the patient during postoperative follow-up. The secondary outcome measures included postoperative complications, length of hospital stay, postoperative mortality, and changes in pancreatic endocrine and exocrine function. Postoperative complications such as pancreatic fistula, hemorrhage, surgical site infection, delayed gastric emptying, respiratory complications, or any other adverse events occurring during the postoperative period were recorded. The duration of hospital stay was calculated from the day of surgery to the day of discharge. Endocrine pancreatic function was evaluated by assessing the development of new-onset diabetes mellitus or worsening glycemic control following surgery.

Exocrine pancreatic function was evaluated based on symptoms suggestive of malabsorption such as steatorrhea and the requirement for pancreatic enzyme supplementation during follow-up.

Statistical Analysis

The collected data were compiled and analyzed using Statistical Package for the Social Sciences (SPSS) software version or equivalent statistical software. Descriptive statistics were used to summarize the data. Continuous variables such as age, duration of hospital stay, and operative time were expressed as mean and standard deviation, while categorical variables such as gender, indications for surgery, type of surgical procedures, and postoperative complications were expressed as frequencies and percentages. Appropriate statistical tests were applied to assess the association between variables wherever necessary. The results were presented using tables for better interpretation and comparison.

Operational Definitions

Chronic Pancreatitis

Chronic pancreatitis was defined as a progressive fibro-inflammatory disease of the pancreas characterized by irreversible morphological changes, fibrosis, and gradual loss of pancreatic exocrine and endocrine function. Diagnosis was established based on characteristic clinical presentation along with radiological findings such as pancreatic ductal dilatation, pancreatic calcifications, pancreatic atrophy, inflammatory pancreatic head mass, or ductal anomalies associated with chronic pancreatitis identified on ultrasonography, contrast-enhanced computed tomography (CECT), magnetic resonance cholangiopancreatography (MRCP), or endoscopic ultrasonography (EUS).

Intractable Pain

Intractable pain was defined as persistent or recurrent abdominal pain attributable to chronic pancreatitis that significantly impaired daily activities and quality of life despite optimal medical management, including analgesics, pancreatic enzyme supplementation, lifestyle modifications, and/or endoscopic interventions. Pain severity was assessed using the Visual Analogue Scale (VAS). Patients with moderate-to-severe pain (VAS ≥ 4) persisting despite appropriate conservative treatment and requiring repeated hospital admissions, opioid analgesics, or causing significant functional limitation were considered to have intractable pain.

Indications for Surgery

Indications for surgical intervention in chronic pancreatitis included intractable abdominal pain not responding to optimal medical or endoscopic treatment, or obstruction of the pancreatic duct, or presence of pancreatic pseudocyst, or biliary obstruction secondary to chronic pancreatitis, or duodenal obstruction, or suspicion of pancreatic malignancy, or recurrent attacks of pancreatitis associated with chronic pancreatitis, or vascular complications related to chronic pancreatitis, or ductal anomalies associated with chronic pancreatitis requiring surgical correction.

Pain Relief

Pain relief was assessed using the Visual Analogue Scale (VAS) and was defined as reduction in pain severity following surgical intervention compared with preoperative baseline assessment.

- Complete pain relief: VAS score 0–1 with no regular analgesic requirement.
- Partial pain relief: <50% reduction in VAS score from baseline.
- No pain relief: No reduction or worsening of pain following surgery.

Postoperative Complications

Postoperative complications were defined as any adverse clinical event occurring during the postoperative hospital

stay or follow-up period. These included postoperative pancreatic fistula, anastomotic leak, surgical site infection, postoperative hemorrhage, delayed gastric emptying, respiratory complications, intra-abdominal collection, sepsis, reoperation and mortality. Complications were documented and graded according to standard institutional protocols and the Clavien–Dindo classification wherever applicable.

Endocrine Insufficiency

Endocrine insufficiency was defined as the development of new-onset diabetes mellitus following surgery or worsening glycemic control in previously diagnosed diabetic patients requiring escalation of medical treatment, including increased oral hypoglycemic agents or insulin therapy.

Exocrine Insufficiency

Exocrine insufficiency was defined as impaired pancreatic exocrine function resulting in steatorrhea, malabsorption, chronic diarrhoea attributable to fat malabsorption, significant weight loss, or the requirement for pancreatic enzyme replacement therapy during follow-up.

Early Surgery and Delayed Surgery

Early surgery was defined as surgical intervention within 3 years of symptom onset, while delayed surgery was defined as surgery performed after more than 3 years.

Results and Observations

Demographics and Clinical Presentation (Table 1)

The majority of patients were in the 31–40 years age group (27.5%), followed by 41–50 years (22.5%) and 51–60 years (20.0%). Patients aged 18–30 years constituted 17.5% of the study population, while those older than 60 years accounted for 12.5%. There was a marked male predominance, with males comprising 77.5% of the patients, whereas females constituted 22.5%. In terms of residence, a higher proportion of patients belonged to rural areas (65.0%), while 35.0% were from urban areas. Abdominal pain was present in all patients (100.0%). Weight loss was observed in 52 (65.0%) patients, followed by loss of appetite in 40 (50.0%) patients. Nausea and vomiting were reported by 34 (42.5%) patients. Steatorrhea was present in 26 (32.5%) patients, while jaundice was observed in 18 (22.5%) patients. An abdominal lump was noted in 14 (17.5%) patients. A majority of patients (70.0%) had a history of alcohol consumption, while 30.0% were non-alcoholic. Smoking was reported in 60.0% of patients, whereas 40.0% were non-smokers. Endocrine dysfunction, in the form of diabetes mellitus, was observed in 30.0% of patients, while 70.0% had no evidence of endocrine insufficiency prior to surgery. Exocrine dysfunction was noted in 32.5% of patients, whereas 67.5% did not exhibit features of exocrine insufficiency. These findings indicate that a significant proportion of patients had functional impairment of the pancreas at the time of surgical intervention.

Table 1: Demographics and Clinical Presentation

Age (years)	N (=80)	%
18 - 30	14	17.5
31 - 40	22	27.5
41 - 50	18	22.5
51 - 60	16	20
>60	10	12.5
Gender		
Male	62	77.5
Female	18	22.5
Residence		
Rural	52	65.0
Urban	28	35.0
Clinical features		
Abdominal pain	80	100.0
Weight loss	52	65.0
Loss of appetite	40	50.0
Nausea/Vomiting	34	42.5
Steatorrhea	26	32.5
Jaundice	18	22.5
Abdominal lump	14	17.5
Alcohol consumption		
Present	56	70.0
Absent	24	30.0
Smoking		
Present	48	60.0
Absent	32	40.0
Endocrine dysfunction		
Present	24	30.0
Absent	56	70.0
Exocrine dysfunction		
Present	26	32.5
Absent	54	67.5

Table 2: Preoperative Radiological findings

Radiological findings	N (=80)	%
Pancreatic ductal dilation	58	72.5
Pancreatic calcifications	50	62.5
Inflammatory mass in pancreatic head	34	42.5
Ductal irregularity/stricture	30	37.5
Pancreatic atrophy	28	35.0
Pancreatic pseudocyst	20	25.0
Biliary duct dilation	18	22.5

Table 3: Surgical interventions

Indication for surgery	N(=80)	%
Intractable abdominal pain	34	42.5
Pancreatic ductal obstruction	16	20.0
Inflammatory mass in pancreatic head	14	17.5
Pancreatic pseudocyst	8	10.0
Biliary obstruction	6	7.5
Duodenal obstruction	2	2.5
Timing of surgery		
Early surgery	38	47.5
Delayed surgery	42	52.5
Surgical procedure performed		
Frey procedure	30	37.5
Lateral pancreaticojejunostomy (LPJ)	22	27.5
Beger procedure	8	10.0
Pancreatoduodenectomy (Whipple's)	6	7.5
Distal pancreatectomy	6	7.5
Cyst drainage procedures	8	10.0
Intraoperative findings		
Dilated main pancreatic duct	56	70.0
Dense peripancreatic adhesions	46	57.5
Pancreatic calcifications	42	52.5
Fibrotic/hard pancreas	40	50.0
Inflammatory mass in pancreatic head	32	40.0
Pancreatic pseudocyst	18	22.5
Biliary compression/involvement	14	17.5
Portal hypertension/Collateral veins	6	7.5

Radiological Findings in patients with Chronic Pancreatitis (Table2)

Pancreatic ductal dilatation was the most common radiological finding, observed in 58 (72.5%) patients. Pancreatic calcifications were noted in 50 (62.5%) patients. An inflammatory mass in the pancreatic head was identified in 34 (42.5%) patients, while ductal irregularity or stricture was present in 30 (37.5%) patients. Pancreatic atrophy was observed in 28 (35.0%) patients. Pancreatic pseudocyst and biliary duct dilatation were detected in 20 (25.0%) and 18 (22.5%) patients, respectively.

Surgical intervention - Indications, procedures done and intraoperative findings (Table 3)

Intractable abdominal pain was the most common indication, present in 34 (42.5%) patients, followed by pancreatic ductal obstruction in 16 (20.0%) patients. An inflammatory mass in the pancreatic head was observed in 14 (17.5%) patients. Pancreatic pseudocyst, biliary obstruction, and duodenal obstruction were noted in 8 (10.0%), 6 (7.5%), and 2 (2.5%) patients, respectively. 38 (47.5%) patients

underwent early surgery while 42 (52.5%) patients were in delayed surgery group. The Frey procedure was the most commonly performed surgery, accounting for 30 (37.5%) patients. Lateral pancreaticojejunostomy (LPJ) was performed in 22 (27.5%) patients. Beger procedure and cyst drainage procedures were each performed in 8 (10.0%) patients. Pancreatoduodenectomy (Whipple's procedure) and distal pancreatectomy were carried out in 6 (7.5%) patients each. Dilatation of the main pancreatic duct was observed in 56 (70.0%) patients. Dense peripancreatic adhesions were present in 46 (57.5%) patients, while pancreatic calcifications and a fibrotic/hard pancreas were noted in 42 (52.5%) and 40 (50.0%) patients, respectively. An inflammatory mass in the pancreatic head was identified in 32 (40.0%) patients. Pancreatic pseudocyst and biliary compression were observed in 18 (22.5%) and 14 (17.5%) patients, respectively. Portal hypertension with collateral veins was encountered intraoperatively in 6 (7.5%) patients. As multiple findings were encountered in some patients, the frequencies are overlapping.

Table 4: Postoperative outcomes and complications

Postoperative complications	N(=80)	%
Surgical site infection (SSI)	12	15.0
Pancreatic fistula	10	12.5
Delayed gastric emptying (DGE)	8	10.0
Respiratory complications	6	7.5
Intraabdominal complications	5	6.25
Postoperative hemorrhage	4	5.0
No complications	40	50.0
Pain relief outcome		
Complete relief	48	60.0
Partial relief	22	27.5
No relief	10	12.5
Postoperative endocrine status		
New-onset/worsened endocrine dysfunction	10	12.5
Unchanged endocrine status	66	82.5
Improved glycemic status	4	5.0
Postoperative exocrine status		
New-onset/worsened exocrine dysfunction	12	15.0
Unchanged exocrine status	62	77.5
Improved exocrine status	6	7.5
Hospital stay (days)		
≤ 7	18	22.5
8 - 14	36	45.0
15 - 21	16	20.0
> 21	10	12.5
Mortality outcome		
Survived	78	97.5
Died	2	2.5

Postoperative complications and outcomes (Table 4)

Overall, 50.0% of patients did not experience any complications following surgery. Among those who developed complications, surgical site infection was the most common, occurring in 15.0% of patients, followed by pancreatic fistula in 12.5%. Delayed gastric emptying was observed in 10.0% of cases. Respiratory complications occurred in 7.5% of patients, while intra-abdominal collection and postoperative hemorrhage were noted in 6.25% and 5.0% of cases, respectively. Complete pain relief occurred in 48 (60%) patients while partial pain relief was present in 22(27.5%) patients. 10(12.5%) patients had no relief in pain even after surgery. New-onset or worsened

endocrine dysfunction was observed in 12.5% patients, while the majority (82.5%) had no change in endocrine status following surgery. Improvement in glycemic status was noted in 5.0% of patients. With regard to exocrine function, 15.0% of patients developed new-onset or worsened exocrine dysfunction postoperatively. Most patients (77.5%) showed no change in exocrine status, while 7.5% demonstrated improvement after surgical intervention. The majority of patients (45.0%) had a postoperative hospital stay of 8–14 days. A shorter hospital stay of ≤7 days was observed in 22.5% of patients, while 20.0% stayed for 15–21 days. Prolonged hospitalization of more than 21 days was noted in 12.5% cases. 97.5% of patients survived the postoperative period, while mortality was observed in 2.5% of patients.

Table 5: Comparison between outcomes across different surgical procedures

Surgical procedures	N (=80)	Complete pain relief N (%)	Complications N (%)	New onset/ worsened endocrine dysfunction N (%)	New onset/ worsened exocrine dysfunction N (%)
Frey procedure	30	18 (60.0)	16 (53.3)	4 (13.3)	5 (16.7)
LPJ	22	14 (63.6)	9 (40.9)	2 (9.1)	3 (13.6)
Beger Procedure	8	4 (50.0)	5 (62.5)	1 (12.5)	2 (25.0)
Whipple's	6	3 (50.0)	5 (83.3)	2 (33.3)	2 (33.3)
Distal pancreatectomy	6	3 (50.0)	3 (50.0)	1 (16.7)	0 (0.0)
Cyst drainage procedures	8	6 (75.0)	2 (25.0)	0 (0.0)	0 (0.0)

Table 6: Comparison of outcomes between early and delayed surgery

Outcome variables	Early Surgery (N = 38)	Delayed Surgery (N = 42)	Significance (P value)
Complete pain relief N(%)	28 (73.7)	20 (47.6)	0.017 Significant
Partial/No relief N(%)	10 (26.3)	22 (52.4)	
Postoperative complications present N(%)	14 (36.8)	26 (61.9)	0.025 Significant
No Postoperative complications N(%)	24 (63.2)	16 (38.1)	
New/worsened endocrine dysfunction N(%)	3 (7.9)	7 (16.7)	0.236
Unchanged/improved endocrine status N(%)	35 (92.1)	35 (83.3)	Not significant
New/worsened exocrine dysfunction N(%)	4 (10.5)	8 (19.0)	0.286
Unchanged/Improved exocrine status N(%)	34 (89.5)	34 (81.0)	Not significant
Hospital stay < 14 days N(%)	30 (78.9)	24 (57.1)	0.037 Significant
Prolonged hospital stay >14 days N(%)	8 (21.1)	18 (42.9)	

Comparison of outcomes across different surgical procedures in patients with chronic pancreatitis (Table 5)

Complete pain relief was observed most frequently in patients who underwent cyst drainage procedures (75.0%), followed by lateral pancreaticojejunostomy (63.6%) and Frey procedure (60.0%). Complete pain relief was achieved in 50.0% of patients who underwent Beger procedure, pancreaticoduodenectomy (Whipple's procedure), and distal pancreatectomy.

Postoperative complications were most common among patients undergoing pancreaticoduodenectomy (83.3%), followed by Beger procedure (62.5%), Frey procedure (53.3%), and distal pancreatectomy (50.0%). Lower complication rates were observed in patients undergoing lateral pancreaticojejunostomy (40.9%) and cyst drainage procedures (25.0%).

New-onset or worsened endocrine dysfunction was highest in patients undergoing pancreaticoduodenectomy (33.3%), followed by distal pancreatectomy (16.7%), Frey procedure (13.3%), Beger procedure (12.5%), and lateral pancreaticojejunostomy (9.1%). No patient undergoing cyst drainage developed endocrine dysfunction.

New-onset or worsened exocrine dysfunction was most frequently observed following pancreaticoduodenectomy (33.3%) and Beger procedure (25.0%). Lower rates

were noted after Frey procedure (16.7%) and lateral pancreaticojejunostomy (13.6%), while no exocrine dysfunction was observed following distal pancreatectomy or cyst drainage procedures.

Comparison of outcomes between early and delayed surgery in patients with chronic pancreatitis (Table 6)

The comparison of outcomes between early and delayed surgery in patients with chronic pancreatitis is shown in Table 6. Patients who underwent early surgery demonstrated statistically significant better outcomes with respect to pain relief ($p = 0.017$), with a higher proportion achieving complete pain relief (73.7%) compared to those undergoing delayed surgery (47.6%). Partial or no pain relief was more common in the delayed surgery group (52.4%) compared to the early surgery group (26.3%). Postoperative complications were also significantly higher ($p = 0.025$) in the delayed surgery group (61.9%) than in the early surgery group (36.8%). Furthermore, delayed surgery was associated with a greater incidence of new or worsened endocrine dysfunction (16.7% vs 7.9%) and exocrine dysfunction (19.0% vs 10.5%), however this association did not achieve statistical significance level. Prolonged hospital stay (>14 days) was observed more frequently in patients undergoing delayed surgery (42.9%) compared to early surgery (21.1%), which was found to be statistically significant ($p = 0.037$). Overall, early surgical intervention

was statistically significantly associated with improved pain relief, fewer complications, and shorter hospital stay compared to delayed surgery.

Discussion

Baseline Demographic Profile

In the present study, chronic pancreatitis requiring surgical intervention was most commonly seen in the 31–40 years age group (27.5%), followed by 41–50 years (22.5%). This suggests that surgically managed chronic pancreatitis predominantly affects individuals in the economically productive age group. Similar findings were reported by Negi et al.[26], Balakrishnan et al.[15], and Büchler et al.[27], who observed that most patients with chronic pancreatitis belonged to the third to fifth decades of life.

A marked male predominance was noted, with males comprising 77.5% of the study population. This finding is consistent with Negi et al.[26] and Balakrishnan et al.[15] who also reported male predominance among patients with chronic pancreatitis. The higher proportion of males may be related to greater exposure to alcohol and smoking, which are important risk factors for chronic pancreatitis.

Most patients in the present study belonged to rural areas (65.0%). This may reflect delayed healthcare access, socioeconomic factors, nutritional status, and referral patterns. Similar rural predominance has been reported in Indian studies, where patients from rural backgrounds often present at a more advanced stage of disease[28].

Clinical Presentation

In the present study, abdominal pain was present in all patients (100.0%), confirming pain as the dominant presenting symptom and the main clinical reason for surgical referral. This finding is comparable with Büchler et al.[27] and Negi et al.[26] who reported abdominal pain in the majority of patients undergoing surgical management for chronic pancreatitis. Weight loss was observed in 65.0% of patients, while loss of appetite was present in 50.0%. These findings indicate significant nutritional compromise in the study population and are comparable with Balakrishnan et al.[15], who reported weight loss in a substantial proportion of patients with chronic pancreatitis. Nausea and vomiting were noted in 42.5% of patients, similar to observations by Büchler et al.[27].

Steatorrhea was present in 32.5% of patients, suggesting exocrine pancreatic insufficiency in nearly one-third of cases. This finding is consistent with Balakrishnan et al.[15]. Jaundice was observed in 22.5% of patients, indicating biliary involvement in a subset of patients, while abdominal lump was noted in 17.5%, likely due to pseudocyst or inflammatory mass. Overall, the findings show that most patients presented with pain along with features of malnutrition, pancreatic insufficiency, or local complications.

Personal History and Risk Factors

In the present study, alcohol consumption was present in 70.0% of patients, making it the most common risk factor associated with chronic pancreatitis requiring surgery. This finding is similar to Balakrishnan et al.[15] and Negi et al.[26], who reported alcohol as a major etiological factor in Indian patients with chronic pancreatitis. Büchler et al.[27] also identified alcohol as an important contributor to chronic pancreatitis in patients requiring operative management.

Smoking was present in 60.0% of patients, indicating its role as an important coexisting risk factor. Previous studies have shown that smoking contributes to disease progression, pancreatic fibrosis, calcification, and poorer clinical outcomes[27]. The high prevalence of both alcohol consumption and smoking in the present study supports their combined role in the progression and severity of chronic pancreatitis.

Preoperative Endocrine and Exocrine Status

In the present study, endocrine dysfunction was present in 30.0% of patients and exocrine dysfunction in 32.5%. This indicates that nearly one-third of patients already had pancreatic functional impairment before surgery. Similar findings were reported by Balakrishnan et al.[15] and Negi et al.[26], who observed endocrine and exocrine insufficiency in a comparable proportion of patients with chronic pancreatitis. These findings reflect advanced disease with progressive pancreatic fibrosis, ductal obstruction, and parenchymal destruction. Preoperative functional status is important because patients with existing insufficiency are more likely to have persistent or worsened dysfunction after surgery.

Radiological Findings

In the present study, pancreatic ductal dilatation was the most common radiological finding, seen in 72.5% of patients, followed by pancreatic calcifications in 62.5%. These findings are consistent with Büchler et al.[27] and Negi et al.[26], who reported ductal dilatation as a common feature in surgically managed chronic pancreatitis. Pancreatic calcification, observed in 62.5%, is a hallmark of long-standing disease and has also been commonly reported by Balakrishnan et al.[15]. Inflammatory mass in the pancreatic head was seen in 42.5%, while pseudocyst and biliary duct dilatation were present in 25.0% and 22.5%, respectively. Overall, the radiological findings indicate advanced structural pancreatic disease and played an important role in determining the type of surgery.

Indications for Surgical Intervention

In the present study, intractable abdominal pain was the most common indication for surgery, present in 42.5% of patients. This is consistent with Büchler et al.[27] and Negi et al.[26], who reported pain refractory to medical treatment as the leading indication for surgery in chronic pancreatitis.

Pancreatic ductal obstruction was observed in 20.0%, while inflammatory mass in the pancreatic head was noted in 17.5%. These findings support the role of drainage and organ-preserving procedures in selected patients. Pancreatic pseudocyst, biliary obstruction, and duodenal obstruction were less frequent indications, seen in 10.0%, 7.5%, and 2.5%, respectively. Since indications may overlap in chronic pancreatitis, the findings reflect the multifactorial basis for surgical decision-making.

Types of Surgical Procedures Performed

In the present study, the Frey procedure was the most commonly performed surgical intervention (37.5%), followed by lateral pancreaticojejunostomy (27.5%). This reflects the predominance of patients with pancreatic ductal dilatation and inflammatory head mass requiring organ-preserving procedures. Similar observations have been reported by Frey and Smith[29] and Negi et al.[26], who demonstrated excellent pain relief with the Frey procedure while preserving pancreatic function. LPJ was the second most common procedure and is considered the preferred drainage operation in patients with a dilated pancreatic duct without an inflammatory head mass, as reported by Büchler et al.[27].

The Beger procedure accounted for 10.0% of cases and was reserved for selected patients with inflammatory enlargement of the pancreatic head. Pancreaticoduodenectomy and distal pancreatectomy were each performed in 7.5% of patients and were mainly indicated in patients with localized disease or suspicion of malignancy. Cyst drainage procedures were performed in 10.0% of patients with symptomatic pancreatic pseudocysts[15]. Overall, the predominance of drainage and organ-preserving procedures in the present study is in accordance with current surgical practice, which favors effective pain relief while preserving pancreatic function and minimizing postoperative morbidity.

Intraoperative Findings

In the present study, dilatation of the main pancreatic duct (70.0%) was the most common intraoperative finding, followed by dense peripancreatic adhesions (57.5%), pancreatic calcifications (52.5%), and a fibrotic pancreas (50.0%). These findings are characteristic of advanced chronic pancreatitis and are comparable with previous reports describing ductal obstruction, fibrosis, and calcification as the predominant pathological features[30-34].

An inflammatory mass in the pancreatic head was observed in 40.0% of patients, supporting the frequent use of Frey and Beger procedures in the present series[30,35]. Pancreatic pseudocyst (22.5%), biliary compression (17.5%), and portal hypertension with collateral veins (7.5%) represented local complications of advanced disease and have been similarly reported in previous surgical studies[31,35,36]. Overall, the intraoperative findings correlated well with the preoperative imaging findings and reflected the chronic inflammatory

and fibrotic changes characteristic of surgically treated chronic pancreatitis.

Postoperative Complications

In the present study, half of the patients (50.0%) experienced no postoperative complications. Among those who developed complications, surgical site infection (15.0%) was the most common, followed by pancreatic fistula (12.5%) and delayed gastric emptying (10.0%). These findings are comparable to previous reports, which have identified pancreatic fistula, delayed gastric emptying, and wound-related complications as the major postoperative events following surgery for chronic pancreatitis[27,29,30].

Postoperative hemorrhage (5.0%), intra-abdominal collection (6.2%), and respiratory complications (7.5%) occurred less frequently and were within the expected range for major pancreatic surgery[31,32]. Although postoperative morbidity remains an important concern, the overall complication profile observed in the present study is consistent with published literature demonstrating lower morbidity following organ-preserving procedures compared with pancreaticoduodenectomy[27,32]. These findings indicate that surgical management of chronic pancreatitis can be performed with acceptable morbidity when appropriate procedures are selected.

Pain Relief Following Surgical Intervention

In the present study, complete pain relief was achieved in 60.0% of patients, while 27.5% experienced partial relief, resulting in an overall pain improvement of 87.5%. These findings are comparable with those reported by Negi et al.[26] and Büchler et al.[27], who demonstrated significant pain relief following surgical intervention, particularly after the Frey procedure and duodenum-preserving pancreatic head resections. The slightly lower rate of complete pain relief in the present study may be attributed to delayed presentation and advanced disease at the time of surgery[15].

Persistent pain was observed in 12.5% of patients, which may be related to advanced pancreatic fibrosis, neuropathic pain mechanisms, or continued alcohol consumption. Previous studies have emphasized that early surgical intervention and organ-preserving procedures provide superior pain control compared to delayed surgery[27]. Overall, the present study confirms that surgical intervention provides effective pain relief in the majority of patients with chronic pancreatitis.

Postoperative Endocrine and Exocrine Outcomes

In the present study, postoperative endocrine and exocrine function remained unchanged in 82.5% and 77.5% of patients, respectively, while only a minority developed new or worsened endocrine (12.5%) or exocrine dysfunction (15.0%). These findings suggest that surgical intervention preserved pancreatic function in most patients. Similar observations have been reported by Izbicki et al.[37] and in studies comparing the Beger and Frey procedures[33],

which demonstrated good preservation of pancreatic endocrine and exocrine function following organ-preserving surgery. Likewise, the meta-analysis by Yang et al.[34] reported lower rates of postoperative pancreatic insufficiency after duodenum-preserving procedures compared with pancreaticoduodenectomy. The relatively favorable functional outcomes in the present study may be attributed to the predominance of Frey procedure and lateral pancreaticojejunostomy. Overall, the findings indicate that organ-preserving and drainage procedures achieve symptom relief while maintaining residual pancreatic function in the majority of patients.

Hospital Stay and Mortality

In the present study, most patients (67.5%) had a postoperative hospital stay of 14 days or less, while prolonged hospitalization (>14 days) was observed in 32.5% of patients. These findings are comparable with those reported by Büchler et al.[27] and Negi et al. [26], who observed shorter hospital stays following drainage and organ-preserving procedures compared with major pancreatic resections.

The postoperative mortality rate in the present study was 2.5%, which is consistent with published reports demonstrating low mortality following pancreatic surgery in experienced centers[26,27]. Prolonged hospital stay was mainly associated with postoperative complications and more extensive surgical procedures. Overall, the findings indicate that surgical management of chronic pancreatitis is safe, with acceptable postoperative recovery and low mortality when performed in appropriately selected patients.

Comparison of Outcomes Across Different Surgical Procedures

In the present study, cyst drainage showed the highest rate of complete pain relief (75.0%) and the lowest complication rate (25.0%); however, this may be related to careful patient selection, as cyst drainage is usually performed in patients with pseudocyst-dominant disease[38]. LPJ achieved complete pain relief in 63.6% of patients with a complication rate of 40.9%, supporting its role in patients with large-duct disease where ductal decompression reduces intraductal pressure[39]. The Frey procedure resulted in complete pain relief in 60.0% of patients with an acceptable complication rate of 53.3%. This supports its usefulness in patients with combined ductal dilatation and inflammatory head mass[35]. Beger procedure and distal pancreatectomy showed complete pain relief in 50.0% of patients, while Whipple's procedure had the highest complication rate (83.3%) and the greatest endocrine and exocrine deterioration (33.3% each), consistent with the higher morbidity associated with major pancreatic resection[31]. Overall, drainage and organ-preserving procedures showed better pain relief with lower functional deterioration, whereas major resection procedures were associated with higher postoperative morbidity and greater pancreatic functional loss.

Comparison of outcomes between early and delayed surgery

In the present study, Early surgery was associated with better outcomes across all assessed parameters. Complete pain relief was higher in the early surgery group compared to the delayed group (73.7% vs 47.6%), while partial or no pain relief was more common in the delayed group (52.4% vs 26.3%). These findings are statistically significant ($p = 0.017$) and consistent with previous studies showing better pain outcomes after earlier intervention[26,27]. Postoperative complications were significantly lower in the early surgery group than in the delayed group (36.8% vs 61.9%, $p = 0.025$). Similarly, new or worsened endocrine dysfunction (7.9% vs 16.7%) and exocrine dysfunction (10.5% vs 19.0%) were all less frequent after early surgery, but they did not reach statistically significance level. Prolonged hospital stay beyond 14 days was also significantly lower after early surgery (21.1% vs 42.9%, $p = 0.037$). This suggests that delayed intervention may be associated with advanced fibrosis, adhesions, progressive pancreatic damage, and poorer postoperative recovery[15,26,27].

Study Limitations

- The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other populations and healthcare settings.
- The sample size was relatively small, which may have reduced the statistical power to detect differences between certain surgical procedures and outcome measures.
- The observational study design limits the ability to establish causal relationships between surgical interventions and clinical outcomes.
- The duration of follow-up was limited, restricting assessment of long-term outcomes such as sustained pain relief, pancreatic functional status, and disease recurrence.
- The choice of surgical procedure was based on clinical indications and surgeon preference rather than random allocation, which may have introduced selection bias.
- Quality of life was not assessed using a validated standardized scoring system, which may have limited comprehensive evaluation of patient-reported outcomes.

Summary

The present prospective observational study was conducted among 80 patients with chronic pancreatitis who underwent surgical intervention at a tertiary care teaching hospital. The study aimed to evaluate the indications for surgical procedures and their outcomes, with particular emphasis on symptom relief, postoperative complications, preservation of pancreatic function, and the impact of timing of surgery on clinical outcomes. The majority of patients were males (77.5%), with the highest proportion belonging to the 31–40 years age group (27.5%). Most patients originated from rural areas (65.0%). Alcohol consumption and smoking

were identified as major risk factors, being present in 70.0% and 60.0% of patients, respectively. Abdominal pain was the universal presenting symptom, occurring in all patients (100%), followed by weight loss (65.0%), loss of appetite (50.0%), nausea and vomiting (42.5%), and steatorrhea (32.5%). Preoperative endocrine and exocrine dysfunction were observed in 30.0% and 32.5% of patients, respectively. Radiological evaluation demonstrated pancreatic ductal dilatation as the most common finding (72.5%), followed by pancreatic calcifications (62.5%), inflammatory mass in the pancreatic head (42.5%), ductal irregularity or stricture (37.5%), and pancreatic atrophy (35.0%). Intraoperatively, dilated main pancreatic duct (70.0%), dense peripancreatic adhesions (57.5%), pancreatic calcifications (52.5%), and fibrotic or hard pancreas (50.0%) were the predominant findings, reflecting the chronic inflammatory and fibrotic nature of the disease. The most common indication for surgical intervention was intractable abdominal pain (42.5%), followed by pancreatic ductal obstruction (20.0%), inflammatory mass in the pancreatic head (17.5%), pancreatic pseudocyst (10.0%), biliary obstruction (7.5%), and duodenal obstruction (2.5%). Among the various procedures performed, the Frey procedure was the most frequently utilized operation (37.5%), followed by lateral pancreaticojejunostomy (27.5%). Beger procedure and cyst drainage procedures accounted for 10.0% each, while pancreaticoduodenectomy and distal pancreatectomy were performed in 7.5% of patients each. Postoperative outcomes demonstrated favorable results. Complete pain relief was achieved in 60.0% of patients, while an additional 27.5% experienced partial relief, resulting in an overall pain improvement rate of 87.5%. Postoperative complications occurred in 50.0% of patients, with surgical site infection (15.0%), pancreatic fistula (12.5%), and delayed gastric emptying (10.0%) being the most common complications. The majority of patients (45.0%) had a postoperative hospital stay of 8–14 days, and postoperative mortality was low at 2.5%. Analysis of postoperative pancreatic function revealed that new-onset or worsened endocrine dysfunction occurred in 12.5% of patients, while new or worsened exocrine dysfunction was observed in 15.0%. Most patients maintained stable endocrine (82.5%) and exocrine (77.5%) function following surgery, indicating satisfactory preservation of pancreatic functional status in the majority of cases.

Comparison of outcomes across different surgical procedures demonstrated that drainage procedures generally produced superior outcomes. Cyst drainage procedures showed the highest rate of complete pain relief (75.0%) and the lowest complication rate (25.0%), followed by lateral pancreaticojejunostomy, which achieved complete pain relief in 63.6% of patients with a complication rate of 40.9%. The Frey procedure provided complete pain relief in 60.0% of patients with acceptable morbidity. In contrast, pancreaticoduodenectomy was associated with the highest

complication rate (83.3%) and the greatest incidence of new or worsened endocrine and exocrine dysfunction (33.3% each), indicating the increased morbidity associated with extensive pancreatic resection.

An important finding of the study was the influence of timing of surgery on postoperative outcomes. Patients undergoing early surgery (within three years of symptom onset) demonstrated significantly better outcomes than those undergoing delayed surgery. Complete pain relief was achieved in 73.7% of patients in the early surgery group compared with 47.6% in the delayed surgery group which was statistically significant. Similarly, postoperative complications were significantly lower in the early surgery group (36.8% vs. 61.9%), while new or worsened endocrine dysfunction (7.9% vs. 16.7%), exocrine dysfunction (10.5% vs. 19.0%), and prolonged hospital stay (21.1% vs. 42.9%) were all less frequent among patients undergoing earlier intervention.

Overall, the findings of the present study demonstrate that surgical intervention is an effective treatment modality for selected patients with chronic pancreatitis, providing substantial pain relief and acceptable postoperative outcomes. Drainage and organ-preserving procedures were associated with favorable functional outcomes and lower morbidity compared with major resection procedures. Furthermore, early surgical intervention was significantly associated with improved symptom control, reduced complication rates, and shorter hospitalization. These findings support the growing evidence favoring timely surgical management in appropriately selected patients with chronic pancreatitis and contribute valuable data to the existing literature regarding procedure selection and outcome optimization.

Conclusion

Chronic pancreatitis requiring surgery predominantly affects middle-aged males with significant exposure to risk factors such as alcohol consumption and smoking. Abdominal pain was identified as the universal and most significant clinical feature, reinforcing its central role as the primary indication for surgical intervention. Many patients present at a relatively advanced stage of the disease having weight loss, exocrine and endocrine insufficiency and radiological evidence of advanced structural disease, often necessitating surgical management. Organ-preserving and drainage procedures, particularly the Frey procedure and lateral pancreaticojejunostomy, constitute the mainstay of surgical treatment and are associated with favorable outcomes with complete pain relief, acceptable complication rates and effectively preserving pancreatic function in the majority of patients. Early surgery was significantly associated with superior pain relief, lower complication rates, and shorter hospital stay. These findings strongly support a shift toward earlier surgical management in appropriately selected patients, rather than prolonged conservative or endoscopic treatment in the face of persistent symptoms.

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Dr. Kartik Sharma and Dr. Pravin Bhingare have contributed equally to the work and should be considered co-first authors.

Declarations

- All authors declares that they have read and approved this manuscript and that they believes this manuscript represents their honest work.
- All authors confirms that this study did not involve animal subjects or tissue.
- All authors declares that no financial support was received from any organisation for the submitted work.
- All authors declares that there are no competing interests

Conflict of Interest

None

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