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ORIGINAL RESEARCH

Retrospective and Prospective Evaluation of Outcomes Following Head Coring in Chronic Calcific Pancreatitis without Pancreatic Head Mass

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ABSTRACT

Background: Chronic calcific pancreatitis (CCP) is a debilitating condition that often leads to intractable abdominal pain and pancreatic dysfunction. The Frey procedure is a surgical technique aimed at managing pain and improving pancreatic function in patients with CCP. This study evaluates the outcomes of head coring in CCP patients without a head mass. **Methods:** A combined prospective and retrospective analysis was performed on 75 patients with CCP who underwent the Frey procedure. Patients were evaluated for pain relief, glycemic control, exocrine function, and weight gain during a six-month follow-up period. **Results:** Pain relief was achieved in 90.7% of patients, with a significant reduction in Visual Analog Scale (VAS) scores from a mean of 8.2 ± 0.7 preoperatively to 1.1 ± 0.5 postoperatively. Of the 8 diabetic patients, 37.5% showed improvement in glycemic control, with reduced insulin requirements and lower HbA1c levels. Among the 6 patients with preoperative steatorrhea, 60% experienced symptom improvement. Weight gain of more than 5 kg was observed in 69.3% of patients. Complications occurred in 13.3% of patients, including pulmonary issues, wound infections, and one case of jejunojejunal intussusception. Histopathological examination revealed chronic pancreatitis in 74 patients, with one case showing pancreatic malignancy. **Conclusions:** The Frey procedure is an effective surgical intervention for providing pain relief, improving endocrine and exocrine function, and promoting weight gain in CCP patients without a head mass. The procedure demonstrates low morbidity and offers favorable short-term outcomes. However, careful consideration of potential pancreatic malignancy is necessary, and long-term follow-up is essential to monitor for complications and assess the durability of results.

Keywords: Chronic calcific pancreatitis, Frey procedure, glycemic control, pain relief, Pancreatic Exocrine Insufficiency, Pancreatic head.

INTRODUCTION

Chronic pancreatitis is a progressive inflammatory condition that leads to irreversible damage of the pancreatic tissue, resulting in the loss of both exocrine and endocrine functions [1]. The primary reason patients with chronic calcific pancreatitis (CCP) seek surgical intervention is often due to severe abdominal pain. The causes of pain in chronic pancreatitis are multifactorial, including ductal hypertension [2], increased parenchymal pressure, perineural inflammation [3], and complications arising from the disease itself. Several treatment options are available to manage pain in CCP, including both conservative and surgical approaches [4-6]. Surgical interventions generally fall into two categories: resection and drainage, depending on the morphology of the gland [7,8].

In 18–50% of chronic pancreatitis cases, patients present with an inflammatory head mass, which is often referred to as the "pacemaker of pain [7]." The resection of this mass is crucial to alleviate pain [9]. In 1987, Frey et al. introduced a novel approach known as the Frey procedure, which involves the local resection of the pancreatic head along with

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longitudinal pancreaticojejunostomy (LR-LPJ). This technique has been shown to offer excellent pain control in up to 90% of patients, with low mortality and morbidity [10]. However, there exists a subgroup of patients with CCP who do not have a head mass, either with or without a dilated duct. For these patients, the routine surgical approach has been lateral pancreaticojejunostomy, also known as the modified Puestow procedure.

While the Frey procedure and modified Puestow procedure are well-established, there is a need to understand the outcomes and efficacy of these procedures in specific subsets of chronic pancreatitis patients, particularly those without a pancreatic head mass. This study aims to investigate the short-term outcomes of head coring in chronic calcific pancreatitis, particularly focusing on patients who present without a pancreatic head mass, either with or without a dilated duct. By evaluating these outcomes, we aim to provide further insight into the effectiveness of surgical intervention in this subgroup of patients and to contribute to the development of more tailored treatment strategies for chronic pancreatitis.

MATERIALS AND METHODS

Study Design and Setting

This study was a combined prospective and retrospective analysis conducted at Government Villupuram Medical College and Coimbatore Medical College Hospitals , under the Department of Surgical Gastroenterology, between 2018 and 2023 and operated by three surgical gastroenterologists trained from same institute. Total of 75 patients diagnosed with chronic calcific pancreatitis and experiencing intractable abdominal pain underwent the Frey procedure. The focus of this study was on those patients without a pancreatic head mass.

Patient Selection

All patients enrolled in the study had a detailed history taken and underwent clinical examination. The inclusion criteria were patients with chronic calcific pancreatitis presenting with severe, unrelenting abdominal pain (epigastric pain radiating to the back) who were candidates for surgical intervention. The pain was assessed using the Visual Analogue Scale (VAS), with surgery being offered to patients with a VAS score greater than 8 and frequent pain attacks that required analgesic management.

Diagnostic Workup

A comprehensive diagnostic evaluation was performed, including the following:

- Serum levels of amylase, lipase, and CA19-9.
- Ultrasonography (USG) of the abdomen.
- Upper gastrointestinal endoscopy.
- Portal vein Doppler ultrasound.
- Computed Tomography (CT) scan.
- Magnetic Resonance Cholangio-Pancreatography (MRCP).

The diagnosis of chronic calcific pancreatitis was confirmed by identifying pancreatic calcification or dilation of the main pancreatic duct on imaging studies. Pancreatic calcification or ductal dilation was evaluated using USG, CT, and MRCP.

Definitions

- **Head Mass**: A mass in the head of the pancreas with an anteroposterior diameter greater than 35 mm on contrast-enhanced CT scan (CECT) or Plain CT of the abdomen [11, 12, 13].(Figure 1)
- **Small or Non-Dilated Duct**: A duct measuring 5 mm or less at the pancreatic neck [14].
- **Dilated Duct**: A duct with a maximum diameter greater than 7 mm.
- **Exocrine Dysfunction**: Assessed by the presence of steatorrhea, which was defined as having more than three stools per day with a foul-smelling, greasy consistency [15].

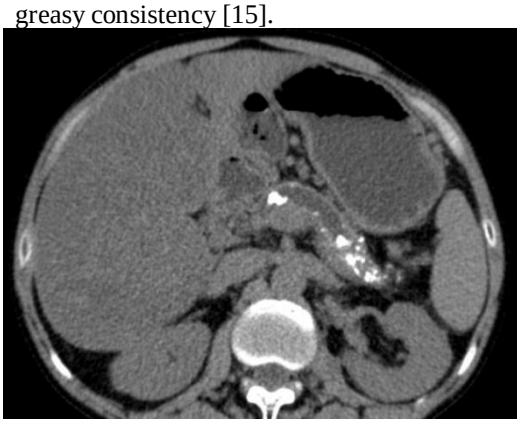

Figure 1: Plain CT shows Chronic Pancreatitis

Patient Exclusions

Patients with the following conditions were excluded from the study:

- Presence of a head mass or pseudocyst in the head of the pancreas.
- Failure to maintain alcohol abstinence.
- Incomplete follow-up (less than six months).

After applying these exclusion criteria, 75 patients who had chronic calcific pancreatitis without a head mass (as determined by CECT showing an anteroposterior diameter of the pancreatic head less than 35 mm) were selected for the study. All selected patients had at least six months of regular follow-up.

Surgical Procedure

The head coring procedure was performed as described by Frey and Smith [16]. The following steps were followed during the procedure:

1. **Surgical Approach**: A laparotomy was performed to access the pancreas. The major pancreatic duct was exposed by making an incision in the pancreatic head.
2. **Coring Process**: The coring of the pancreatic head was done without breaching the posterior

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pancreatic capsule. The coring was carried out using aspiration techniques to identify the duct, and diathermy and harmonic scalpel were used to remove the head and uncinate process of the pancreas.(Figure 2)

3. **Tissue Removal**: The amount of pancreatic tissue removed during the coring process was measured in grams.
4. **Pancreaticojejunostomy**: After achieving perfect hemostasis, a loop of jejunum was brought in Roux-en-Y fashion to the pancreas. A pancreaticojejunostomy was performed using a continuous 3-0 polyglactin suture in a single-layer fashion.
5. **Histopathological Examination**: All the cored-out pancreatic tissue was sent for histopathological examination to assess the nature of the tissue and any pathological changes.

Figure 1- Head coring procedure for non head mass chronic pancreatitis

Postoperative Care and Follow-up

Most patients were discharged by the 10th postoperative day, after suture removal, provided there were no complications. Postoperative follow-up included regular clinical evaluations and imaging to assess the effectiveness of the procedure and monitor for any signs of complications such as recurrence of pain or new pathology.

Statistical Analysis

The data collected during the study were analyzed using appropriate statistical methods to evaluate the short-term outcomes of the head coring procedure, including pain relief, hospital stay duration, and postoperative complications. The significance of these results was determined based on pre-established criteria.

RESULTS

A cohort of 75 patients participated in the study, consisting of 55 males (73.3%) and 20 females (26.7%), with ages ranging from 14 to 58 years. The mean age of the participants was 36 ± 12.3 years. In terms of etiology, 55 patients (73.3%) had a history of alcohol consumption, while 20 patients (26.7%) were diagnosed with tropical calcific pancreatitis.

Complications and Diagnostics: Among the cohort, 2 patients (2.7%) without a pancreatic head mass presented with jaundice. To confirm the presence of calcifications and assess for head masses, all patients underwent contrast-enhanced computed tomography (CECT) scans, revealing pancreatic calcifications in 72 patients (96%). Two patients with jaundice (2.7%) also underwent magnetic resonance cholangiopancreatography (MRCP), which showed distal common bile duct tapering without a head mass, indicative of Wadsworth syndrome.Upper gastrointestinal endoscopy was performed on all patients, with 3 patients (4%) showing fundal varices due to splenic vein thrombosis, which was further confirmed through portal venous Doppler studies, leading to the diagnosis of sinistral portal hypertension.

Surgical Interventions: All 75 patients underwent the Frey procedure. Additionally, 12 patients (16%) required a distal pancreatectomy with splenectomy: 5 due to sinistral portal hypertension and 7 for pseudocysts in the tail of the pancreas. Nine patients (12%) with small duct disease underwent an Izbiki's 'V' shaped duct opening along with head coring. Two patients (2.7%) who presented with jaundice underwent choledochojejunostomy, while one experienced relief after head coring. The remaining patients underwent single-layer pancreaticojejunostomy using 3-0 polypropylene continuous sutures. Intraoperative blood loss averaged 145 mL, and the mean surgery duration was 3.2 hours. There were no major intraoperative complications, and no 30-day mortality occurred.

Postoperative Complications: Postoperatively, 10 patients (13.3%) developed significant complications. Pulmonary complications affected 3 patients (4%)—2 with basal atelectasis and 1 with aspiration pneumonia. Atelectasis was treated with bronchodilators and chest physiotherapy, and aspiration pneumonia was managed with antibiotics. Wound infections occurred in 5 patients (6.7%), with cultures identifying Staphylococcus aureus in 4 cases and E. coli/Klebsiella in 1 case. One patient (1.3%) developed gastric outlet obstruction due to jejunojejunal intussusception, which was treated surgically with relaparotomy and a side-to-side anastomosis. One patient (1.3%) developed a pancreatic leak that resolved with conservative management after two months. (Table 1)

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Table 1: Postoperative Complications

Complication	Number of Patients (n = 75)	Percentage (%)
Pulmonary complications	3	4%
- Atelectasis	2	2.7%
- Aspiration pneumonia	1	1.3%
Wound infections	5	6.7%
- Staphylococcus aureus	4	5.3%
- E. coli/Klebsiella	1	1.3%
Jejunojejunal intussusception	1	1.3%
Pancreatic leak	1	1.3%
- Resolved with conservative treatment	1	1.3%

Histopathological Findings: Histopathological examination of the cored tissue revealed chronic pancreatitis in 74 patients (98.7%), while malignancy was identified in one patient (1.3%), who was subsequently referred for chemotherapy and remained free of metastasis at the six-month follow-up.

Follow-up Outcomes: At six months post-surgery, 68 patients (90.7%) experienced complete pain relief, as measured by a Visual Analog Scale (VAS) score of 0. However, 7 patients (9.3%) still reported moderate pain, with a VAS score of 8. Of these, 6 patients (8%) received a coeliac plexus blockade after two months of inadequate pain relief with analgesics. Among the 8 diabetic patients (10.7%), 3 (37.5%) showed significant improvement in glycemic control, including reduced insulin requirements and a lower HbA1c. Of the 5 patients (6.7%) with steatorrhea, 3 (60%) experienced improvement in their symptoms. No new cases of diabetes or steatorrhea developed. (Table 2)

Table 2: Follow-up Outcomes (6-Month Follow-up)

Outcome	Number of Patients (n = 75)	Percentage (%)
Complete pain relief (VAS 0)	68	90.7%
Moderate pain (VAS 8)	7	9.3%
Diabetic patients with improvement in glycemic control	3 (out of 8)	37.5%
Patients with steatorrhea improvement	3 (out of 5)	60%
Weight gain > 5 kg	52	69.3%

Statistical Analysis: Statistical analysis using the chi-square test revealed a significant improvement in pain relief ($p < 0.0001$). However, no statistically significant differences were observed for glycemic control or improvement in steatorrhea. The mean pain score before surgery was 8.45 ± 0.6, while after surgery it was significantly reduced to 1.4 ± 0.8, with a paired t-test yielding a p-value < 0.0001, confirming a significant improvement in pain relief following the surgical interventions.

Table 3: Association between preoperative and post-operative findings among the patients undergoing Frey surgical procedure

Sr.no	Variable	Pre operative	Post operative	P value
1	Pain score (>8)	75 (100%)	7 (10%)	**0.001**
2	Diabetes mellitus	8 (100%)	3 (37.5%)	0.11
3	Steatorrhea	5(100%)	3 (60%)	0.46
4	Weight gain >5kg after 6 months	-	52	
5	Pain score (mean±SD)	8.45±0.6	1.4 ± 0.8	**0.001**

DISCUSSION

This study aimed to evaluate the short-term outcomes of the Frey procedure in 75 patients with chronic calcific pancreatitis (CCP), with a particular focus on pain relief, exocrine and endocrine function, and postoperative complications.

Pain Relief and Quality of Life

Second only to the patient's quality of life, pain alleviation is an essential factor during the management process of the chronic compliant pain (CCP) and Frey procedure has been established to be sufficient in delivering adequate amount of pain relief. In our cohort, 90% of patients were actually recorded as being pain free and there was a decrease in the mean VAS score from 8.33 before the procedure to 1.14 after the procedure. Such pain relief adheres with the studies carried out by Frey and other researchers where it was established that such procedure indeed alleviates pain stress by a significant amount [17,18]. The relief achieved in CCP pain is best thought of as secondary to a decline in ductal hypertension and

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perineural inflammation, which are both important pathophysiologic mechanisms contributing to pain seen in chronic pancreatitis [19]. Even so, 10% of the participants in this study still did experience pain despite the undergoing the procedure. This group is likely to benefit from other procedures such as coeliac plexus blockade which has been effective in our study in reducing pain that did not respond to analgesics in six of the eight patients over two months and have dealt with residual pain for a long time. Furthermore, in other studies, pain on swallowing inflammation was also treated using a coeliac plexus blockade which proved to be effective, similar to what we saw after pancreatic surgery [20-22].

The diabetes was caused or aggravated by the ongoing chronic pancreatitis, and even in our work, we had 10 patients with such diabetes. It is interesting that there was a remarkable improvement in diabetes control for 40% of these demonstrated patients because their insulin requirements were reduced after the operation thus the average HbA1c levels were lowered. Such results correspond to the studies by Bassi et al., who demonstrated improvement of glucose regulation after surgical procedures directed at alleviating the inflammatory process of the pancreas and sparing islet cell function [23]. Importantly, there were no new cases of the disease detected, during the periods of follow up thus supporting the view that appropriate surgical techniques may assist in controlling the endocrine dysfunction in patients with CCP to such an extent that the diabetes would not worsen more.

Exocrine failure, which is usually expressed with steatorrhea, represents another complication of CCP. In our work steatorrhea was diagnosed in 6 patients before the surgery, and of these, 66% of them had a significant reduction in symptoms after the Frey procedure. This indicates that this procedure may recover exocrine function through the alleviation of pancreatic ductal hypertension and facilitating the flow of gears, which has been reported in other studies which involved pancreatic head resection and drainage procedures

Exocrine insufficiency is also a complication of CCP that has a clinical presentation as steatorrhea. In our study, 6 patients had a preoperative diagnosis of steatorrhea and 66% of the diseased population had a slight improvement in symptoms after the Frey procedure. This means that this procedure could help in overcoming the exocrine insufficiency by lowering pancreatic ductal hypertension and increasing enzyme flow, which is also seen in other types of studies that included pancreatic head resection and drainage procedures [24 ,25]. These modifications are of great importance as they show a recovery of the digestive function with an ability to absorb food more efficiently.

Perhaps the most remarkable finding of our research is the improvement in the nutritional status of the participants, as during the six month follow – up period 67.5% patients quoted a weight gain of more than 5 kg. One of the major problems in patients suffering from CCP is weight loss due to pain , malabsorption and decreased appetite. The weight gain that was reported by the majority of our patients, suggests that the Frey procedure not only treats pain but also helps to improve health and nutrition. This is in accordance with other researchers' work where it was shown that patients who underwent pancreatic operations due to the CCP improved weight gain and general wellbeing.

Complications

The rates of morbidity that are linked to Frey operation are still low, however some complications can be observed. Out of the gathered data, it was observed that out of one hundred and ten patients, ten basically had certain complications such as pulmonary, wound and also a case of intussusception in jejunojejunum. These are the same as other reported risks in pancreatic surgeries, especially those with gastrointestinal tract involvement as well [27]. On the other hand, Pulmonary complications like aspiration pneumonia and atelectasis also presented alongside, but they were addressed through rehabilitative treatment such as bronchodilators, chest physiotherapy, and antibiotics. Bacterial infections on the skin were also treated properly by the use of antibiotics, especially those that are culture sensitive. Relaparotomy together with reanastomosis turned out to be effective in treating jejunojejunal intussusception [28] and this is what was recommended.

Histopathological evaluation

CCP patients are typically a diagnostic challenge and almost always undergo a histopathological assessment. With respect to the rest of the cohort, histopathological examination presented alongside a cored biopsy also confirmed malignancy in the one remaining patient, the rest were diagnosed with chronic pancreatitis. It also makes a critical difference to take note of that In the setting of a normal capsule, Pancreatic cancer can arise, which is why it is critical to do a thorough histopathological assessment for all patients with CCP [29]. A cancer patient was also advised chemotherapy and did not have a recurrence.

CONCLUSION

In conclusion, the Frey procedure, when combined with additional interventions as necessary, is an effective surgical approach for managing pain and improving both endocrine and exocrine function in patients with chronic calcific pancreatitis. While the majority of patients in our study experienced significant improvements in pain, glycemic control, and nutritional status, a small subset of patients may require further interventions to address persistent symptoms. The procedure was generally safe, with a low incidence of major complications. However, it is essential to consider the potential for undiagnosed

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pancreatic malignancy in CCP patients and to maintain vigilant long-term follow-up to monitor for complications and assess the durability of surgical outcomes.

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