

Case Series

Frey procedure in pediatric chronic calcific pancreatitis: a single-centre case series

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ABSTRACT

Chronic pancreatitis in children is an uncommon but debilitating disorder characterized by recurrent abdominal pain, pancreatic ductal abnormalities, calcification, and progressive loss of pancreatic function. Although medical and endoscopic therapies are useful in selected patients, persistent pain, recurrent pancreatitis, ductal obstruction, pancreatic calculi, and impaired quality of life may necessitate surgical intervention. The Frey procedure, combining pancreatic head coring with longitudinal pancreaticojejunostomy, provides pancreatic ductal decompression while preserving pancreatic tissue and function. Published pediatric experience remains limited. The aim of the study is to describe the clinical presentation, indications, operative findings, technical challenges, postoperative complications, and follow-up outcomes of children with chronic pancreatitis managed with the Frey procedure. A single-centre retrospective case series of six pediatric patients with chronic pancreatitis who underwent surgical management with the Frey procedure. Clinical records were reviewed for age, etiology, previous endoscopic interventions, imaging findings, indications for surgery, operative findings, postoperative complications, pain, quality of life, and follow-up outcomes. Particular attention was given to pancreatic duct morphology and technical challenges encountered during surgery. The patients ranged from 6 years 4 months to 13 years of age. Etiologies included idiopathic disease and pancreas divisum. Several patients had chronic calcific pancreatitis with pancreatic ductal calculi and ductal dilatation. Recurrent pancreatic-type abdominal pain was the principal indication for surgery, and some patients had previously undergone ERCP and pancreatic duct stenting. Imaging demonstrated pancreatic atrophy, calcification, ductal dilatation, pancreatic calculi, and pseudocyst formation in individual cases. One child had a non-dilated pancreatic duct measuring less than 2 mm with splenic vein thrombosis and left-sided portal hypertension, creating a major technical challenge. Postoperative complications included pancreatic fistula in one patient and transient blood-stained drain output in another. One patient developed a lower common bile duct stricture with jaundice three years after surgery, which was managed with PTBD following failed ERCP. At six years of follow-up, this patient remained asymptomatic. Follow-up in the other patients demonstrated improvement in pain and quality of life. The Frey procedure appears to be a feasible organ-preserving surgical option for carefully selected children with chronic pancreatitis and debilitating pain, particularly those with calcific disease, ductal obstruction, pancreatic calculi, or failure of endoscopic management. The series also highlights the technical challenges encountered in young children with an atrophic or minimally dilated pancreatic duct and associated portal hypertension. Larger multicentre studies with standardized assessment of pain, pancreatic function, quality of life, and long-term outcomes are required.

Keywords: Frey procedure, Pediatric chronic pancreatitis, Chronic calcific pancreatitis, Pancreatic duct calculi, Pancreaticojejunostomy, Pediatric pancreatic surgery

INTRODUCTION

Chronic pancreatitis (CP) is a progressive fibro-inflammatory disorder characterized by irreversible destruction of the pancreatic parenchyma, fibrosis, ductal abnormalities, and gradual loss of endocrine and exocrine pancreatic function. Although uncommon in children, its recognition has increased with advances in imaging and genetic evaluation.

The estimated incidence of pediatric chronic pancreatitis is approximately 2 per 100,000 children, with a prevalence of 5.8 per 100,000 population. Nearly one-third of children with recurrent acute pancreatitis may eventually progress to chronic pancreatitis, particularly those with hereditary disease or structural pancreatic abnormalities. In tropical countries such as India, tropical chronic calcific pancreatitis remains an important cause of pancreatic duct calculi in children.^{1,2}

Unlike adult disease, pediatric chronic pancreatitis is mainly associated with genetic mutations, congenital pancreatic duct anomalies, metabolic disorders, autoimmune pancreatitis, trauma, and idiopathic causes. The INSPPIRE consortium has identified PRSS1, SPINK1, CFTR, CTFR, and CPA1 mutations among important genetic risk factors.^{1,3} Repeated inflammation results in fibrosis, pancreatic duct obstruction, protein plug formation, intraductal calculi, and pancreatic calcification. Progressive ductal hypertension and inflammation of the pancreatic head contribute to chronic abdominal pain, while continued destruction of pancreatic tissue may cause exocrine insufficiency, malnutrition, steatorrhea, and diabetes mellitus.²

Children typically present with recurrent or persistent epigastric pain, recurrent attacks of acute pancreatitis, nausea, vomiting, weight loss, poor growth, steatorrhea, and diabetes mellitus. Chronic pain remains a major indication for intervention and may significantly impair quality of life, school attendance, and psychosocial development. Diagnosis is established using clinical findings supported by ultrasonography, contrast-enhanced CT, MRCP, endoscopic ultrasound, and ERCP. Typical imaging findings include pancreatic duct dilatation, intraductal calculi, pancreatic calcification, glandular atrophy, and inflammatory enlargement of the pancreatic head. MRCP is an important non-invasive modality for evaluation of pancreatic duct anatomy.^{1,3} Management aims to relieve pain, preserve pancreatic function, improve nutrition, and prevent recurrent pancreatitis. Initial treatment includes analgesia,

pancreatic enzyme supplementation, nutritional rehabilitation, and management of endocrine and exocrine insufficiency.

Endoscopic therapy, including pancreatic sphincterotomy, stone extraction, ductal dilatation, and stenting, may provide symptom relief in selected patients. However, repeated interventions may be required, and extensive ductal calculi or inflammatory pancreatic head disease may ultimately require surgical drainage. Therapeutic ERCP has an important role in selected children with pancreatic duct strictures, ductal dilatation, and pancreatic duct stones, including stone extraction with or without ESWL.^{4,5} Surgery is generally considered for children with persistent pain, recurrent pancreatitis despite medical or endoscopic therapy, dilated pancreatic ducts, inflammatory pancreatic head disease, multiple ductal calculi, biliary obstruction, or impaired quality of life.⁶

The Frey procedure, first described by Frey and Smith in 1987, combines local resection (coring) of the pancreatic head with longitudinal pancreaticojejunostomy. This operation decompresses the pancreatic head and main pancreatic duct while preserving the duodenum and distal bile duct.⁷ The rationale for head coring is based on the role of the pancreatic head in pain generation through neural inflammation and ductal obstruction. The Frey procedure therefore provides both head decompression and ductal drainage while preserving pancreatic tissue and avoiding pancreaticoduodenectomy.⁷

Published pediatric experience remains limited. Previous reports include retrospective case series and isolated case reports describing favorable pain relief, acceptable postoperative morbidity, and preservation of pancreatic function. Rollins and Meyers reported 11 children, of whom 8 underwent the Frey procedure, with good or excellent outcomes in most patients.⁸ Ray et al subsequently reported a larger single-centre series of 24 children undergoing the Frey procedure, with 91% remaining pain-free at a median follow-up of 29 months.⁹ Long-term follow-up from the same group has also demonstrated sustained pain relief and preservation of endocrine and exocrine function.¹⁰ In view of the limited pediatric literature, particularly in very young children and in those with small or minimally dilated pancreatic ducts, we present our institutional experience with six pediatric patients undergoing the Frey procedure, with emphasis on indications, technical challenges, postoperative outcomes, and long-term follow-up.

Table 1: Summary of selected published pediatric experience with the Frey procedure.

S. No.	Author (Year)	Country	Study design	No. of pediatric Patients	No. of Frey procedures	Major findings
1	Rollins et al (2004) ⁸	USA	Retrospective case series	11	8	First pediatric series; excellent pain relief with minimal postoperative morbidity and good long-term outcomes.

Continued.

S. No.	Author (Year)	Country	Study design	No. of pediatric Patients	No. of Frey procedures	Major findings
2	Okuyama et al (2010) ¹¹	Japan	Case report	1	1	Successful Frey procedure in a child with congenital pancreatobiliary disease, demonstrating feasibility and safety.
3	Ray et al (2015) ⁹	India	Retrospective single-centre study	24	24	Largest dedicated pediatric Frey series; 91% long-term pain relief, no operative mortality, median hospital stay of 8 days.
4	Ray et al (2020) ¹⁰	India	Retrospective long-term follow-up study	54	25	Excellent long-term pain relief with preservation of endocrine and exocrine pancreatic function and improved quality of life.

CASE SERIES

Study design and patient selection

This retrospective case series included six pediatric patients with chronic pancreatitis who underwent the Frey procedure at our institution. Clinical records were reviewed for demographic characteristics, duration and pattern of symptoms, underlying etiology, previous endoscopic interventions, imaging findings, indications for surgery, operative findings, postoperative complications, and follow-up outcomes.

The patients ranged in age from 6 years 4 months to 13 years. The etiologies represented in the series included idiopathic chronic pancreatitis and pancreas divisum. The principal indication for surgery was recurrent or persistent pancreatic-type abdominal pain associated with impaired quality of life, with additional indications including chronic calcific disease, ductal dilatation, pancreatic calculi, and failure or inadequacy of previous endoscopic management.

Preoperative assessment

Preoperative assessment included clinical evaluation and pancreatic imaging. Contrast-enhanced CT demonstrated varying combinations of pancreatic atrophy, calcification, ductal dilatation, pancreatic calculi, and pseudocyst formation. Previous ERCP and pancreatic duct stenting were documented in selected patients. Quality of life was assessed in individual patients using domains including pain severity and frequency, physical functioning, emotional well-being, social functioning, school activities, and nutritional impact; a score of 45/100 was documented in the first two cases.

Surgical technique

The Frey procedure consisted of pancreatic head coring combined with longitudinal pancreaticojejunostomy. The pancreatic head was cored while preserving a rim of

pancreatic tissue adjacent to the duodenum. The main pancreatic duct was identified and opened longitudinally from the head toward the tail, and ductal and parenchymal calculi were removed when present.

A Roux-en-Y jejunal limb was prepared and a longitudinal pancreaticojejunostomy was performed, followed by jejunojejunostomy to restore bowel continuity. In selected cases, associated pathology such as a pancreatic pseudocyst was drained during the procedure.

Technical modifications were required in the patient with a pancreatic duct measuring less than 2 mm, splenic vein thrombosis, splenomegaly, and left-sided portal hypertension. In this child, the pancreatic duct was identified from the head side and carefully dissected with a fine mosquito forceps after adequate pancreatic head coring, allowing completion of the drainage procedure.

Outcome assessment

Postoperative outcomes included hospital course, pancreatic fistula, drain-related events, vascular complications, late biliary complications, recurrent abdominal pain, and clinical status during follow-up. Follow-up duration varied among patients, with the longest documented follow-up being six years.

RESULTS

Patient characteristics and clinical presentation

Six children underwent the Frey procedure during the study period represented by this case series. The youngest patient was a 6-year-4-month-old girl and the oldest was a 13-year-old girl. Recurrent or persistent pancreatic-type abdominal pain was the principal indication for surgery across the series. Several patients had recurrent hospital admissions, impaired quality of life, pancreatic calculi, and ductal dilatation. Etiologies included idiopathic chronic pancreatitis and pancreas divisum.

Table 2: Summary of the six pediatric patients.

Case	Age/sex	Etiology / key features	Pancreatic duct	Previous endoscopic treatment	Procedure / key operative finding	Follow-up / outcome
1	13 y / F	Chronic calcific pancreatitis; pain, weight loss, steatorrhea	Dilated; calculi	Not specified	Head coring + longitudinal PJ; multiple ductal/parenchymal calculi removed	3 months; clinically stable
2	11 y / M	Chronic pancreatitis; recurrent pain	Not specified	Not specified	Frey procedure	CBD stricture at 3 years; PTBD after failed ERCP; asymptomatic at 6 years
3	8 y / M	Pancreas divisum; chronic pancreatitis	~3 mm; atrophic/fibrotic pancreas	ERCP and stenting ×2; cystogastrostomy	Head coring + longitudinal PJ	Improved pain and quality of life
4	6 y 4 M / F	Idiopathic; recurrent pancreatitis; pseudocyst	4–5 mm	Not specified	Frey + pseudocyst drainage	Pancreatic fistula; drain ~4 weeks; subsequently stable
5	12 y	Chronic calcific pancreatitis with diabetes mellitus	>5 mm; multiple calculi	Not specified	Frey; intraoperative/postoperative octreotide	Prolonged postoperative course; no fistula; stable
6	9 y / M	Atrophic calcific CP; splenic vein thrombosis; left-sided portal hypertension	<2 mm	Not specified	Frey; difficult duct identification and dissection	Transient blood-stained drain output; CTA negative for aneurysm; stable

Case 1

A 13-year-old girl presented with a 4-year history of intermittent abdominal pain, usually relieved by oral analgesics and occasionally requiring intravenous analgesics during severe episodes. She also had loss of appetite, significant weight loss, and steatorrhea.

Clinical evaluation and imaging were consistent with chronic calcific pancreatitis. Her quality of life was assessed across pain, physical, emotional, social, school, and nutritional domains, with a score of 45/100.

Preoperative contrast-enhanced CT of the abdomen demonstrated extensive pancreatic calcification with multiple pancreatic calculi and dilatation of the main pancreatic duct, predominantly involving the pancreatic head and body.

Intraoperatively, the pancreas was noted to have multiple calculi within the main pancreatic duct and pancreatic parenchyma, with a dilated main pancreatic duct. The pancreatic head was cored out while preserving a rim of pancreatic tissue adjacent to the duodenum. The main pancreatic duct was identified and opened longitudinally from the head toward the tail, and multiple ductal and parenchymal calculi were extracted. A Roux-en-Y jejunal limb was prepared, and a longitudinal

pancreaticojejunostomy was performed, followed by jejunojejunostomy to restore bowel continuity. A drain was placed adjacent to the pancreaticojejunostomy.

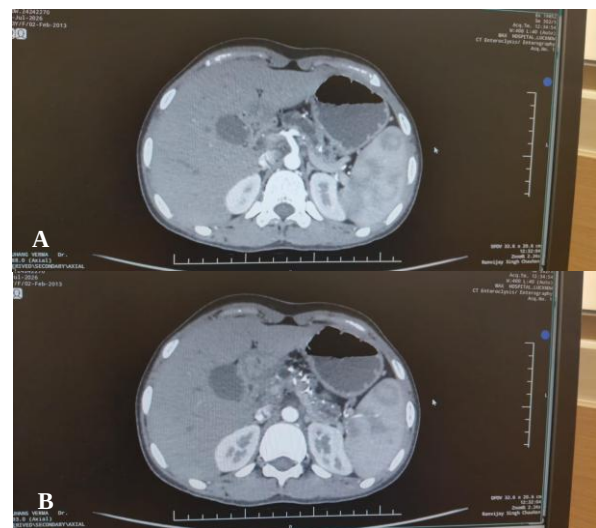


Figure 1 (A and B): Preoperative contrast-enhanced CT images demonstrating chronic calcific pancreatitis with extensive pancreatic calcification, multiple pancreatic ductal/parenchymal calculi, and dilatation of the main pancreatic duct.



Figure 2: Intraoperative appearance of the pancreas during the Frey procedure.

The postoperative course was uneventful. The patient was initially managed in the surgical intensive care unit and was transferred to the ward on postoperative day 2. Oral intake was progressively resumed and tolerated, with return of bowel function. She was discharged in a stable condition with the drain in situ and planned outpatient follow-up. At three months, she remained clinically stable.

Case 2

An 11-year-old boy presented with recurrent intermittent abdominal pain for 4 years, usually relieved by oral analgesics and occasionally requiring intravenous analgesics during severe episodes. He had frequent hospital admissions during the preceding year, with impaired quality of life and a quality-of-life score of 45/100. There was no history of significant weight loss or steatorrhea. CT imaging demonstrated features consistent with chronic calcific pancreatitis. In view of recurrent abdominal pain secondary to chronic pancreatitis, he underwent a Frey procedure. The patient was followed regularly and remained clinically well initially. Three years after surgery, he developed jaundice secondary to an intrapancreatic lower common bile duct stricture. ERCP was attempted but was unsuccessful. Percutaneous transhepatic biliary drainage (PTBD) was performed and subsequently internalized. The PTBD was removed after three months following successful management of the biliary obstruction. At six years of follow-up, he remained clinically stable without recurrent abdominal pain or further biliary symptoms.

Case 3

An 8-year-old boy presented with recurrent attacks of acute pancreatitis since the age of 2 years. The underlying

etiology was pancreas divisum. He underwent ERCP with pancreatic duct stenting on two occasions and subsequently underwent endoscopic cystogastrostomy for a pancreatic fluid collection. At 6 years of age, he developed established chronic pancreatitis with pancreatic atrophy, parenchymal calcification, and pancreatic ductal dilatation. In view of recurrent pancreatic-type abdominal pain affecting his day-to-day activities despite previous endoscopic interventions, he underwent a Frey procedure. Intraoperatively, the pancreas was hard, fibrotic, and atrophic, with a pancreatic duct measuring approximately 3 mm. Pancreatic head coring with longitudinal pancreaticojejunostomy was performed. The postoperative course was uneventful. On follow-up, the patient showed improvement in pancreatic-type abdominal pain and quality of life, with improved daily functioning.

Case 4

A 6-year-4-month-old girl, the youngest patient in the series, presented with recurrent abdominal pain of pancreatic origin. She had a 5-year history of recurrent pancreatitis, during which she was admitted five times for episodes of acute pancreatitis and acute-on-chronic pancreatitis. The etiology was considered idiopathic. CT imaging demonstrated an atrophic pancreas with pancreatic ductal dilatation measuring 4–5 mm and a small pseudocyst measuring approximately 3 × 2 cm in the body and tail of the pancreas. In view of chronic pancreatitis with recurrent pancreatic-type abdominal pain, she underwent pancreatic head coring with drainage of the pseudocyst and longitudinal pancreaticojejunostomy (Frey procedure). The patient was discharged on postoperative day 8. The postoperative course was complicated by a pancreatic fistula, requiring the drain to be maintained for approximately four weeks. She was subsequently discharged with a low-volume pancreatic fistula producing approximately 20–30 mL of clear pancreatic fluid per day. On subsequent follow-up, the patient remained clinically stable.

Case 5

A 12-year-old patient presented with recurrent abdominal pain for 3 years, requiring both oral and intravenous opioid analgesics for pain control. Evaluation revealed chronic calcific pancreatitis associated with diabetes mellitus. CT imaging demonstrated multiple parenchymal and pancreatic ductal calculi with pancreatic ductal dilatation greater than 5 mm. In view of chronic calcific pancreatitis with a dilated pancreatic duct and recurrent pain requiring opioid analgesia, the patient underwent a Frey procedure. Intraoperatively, the pancreas was relatively soft, with multiple large pancreatic calculi and a dilated pancreatic duct. Intraoperative octreotide 50 µg subcutaneously was administered, and postoperative octreotide was continued until oral feeding was started. The postoperative course was prolonged; however, there

was no evidence of pancreatic fistula. On subsequent follow-up, the patient remained clinically stable.

Case 6

A 9-year-old boy was diagnosed with chronic pancreatitis with a disease duration of approximately four years. CT imaging demonstrated pancreatic atrophy and calcification with a non-dilated pancreatic duct measuring less than 2 mm. There was mild peripancreatic inflammation with splenic vein thrombosis and splenomegaly, suggestive of left-sided portal hypertension. The common bile duct measured 8–9 mm, without jaundice. Liver function tests were normal, with only marginal elevation of alkaline phosphatase. The principal indication for surgery was recurrent abdominal pain.

Intraoperatively, the pancreas was atrophic and firm, with significant peripancreatic inflammation, adhesions, and collateral vessels suggestive of left-sided portal hypertension. Following adequate pancreatic head coring, the pancreatic duct was identified from the head side and carefully dissected using a fine mosquito forceps, after which the drainage procedure was completed. The operative duration was approximately six hours, compared with an average operative duration of 4.5–5 hours among the other pediatric Frey procedures in the series. Postoperatively, the patient developed mild blood-stained drain output on postoperative day 3, without a fall in hemoglobin. CT angiography showed no evidence of an aneurysm. On subsequent follow-up, the patient remained clinically stable.

DISCUSSION

The present six-patient case series demonstrate the feasibility of the Frey procedure in children with chronic pancreatitis across a range of pancreatic duct morphologies and clinical presentations. The patients were young, with the youngest aged 6 years 4 months, and recurrent pancreatic-type abdominal pain with impaired quality of life was the dominant indication for surgery.

The management of pediatric chronic pancreatitis is challenging because the disease may persist for many years and repeated episodes of pain can interfere with nutrition, growth, schooling, and psychosocial development. Medical therapy and endoscopic intervention remain important components of initial management; however, persistent symptoms, ductal obstruction, pancreatic calculi, and failure of endoscopic therapy may necessitate surgical drainage.^{1,6}

The Frey procedure combines pancreatic head coring with longitudinal pancreaticojejunostomy, thereby addressing both head-dominant inflammatory disease and ductal hypertension while preserving the duodenum and distal bile duct.⁷ This is particularly attractive in children because it is an organ-preserving procedure and avoids

the greater physiological consequences of pancreatic resection.

The published pediatric literature remains limited and is predominantly composed of retrospective case series and case reports. Rollins and Meyers reported 11 children, including eight who underwent the Frey procedure, with symptomatic relief and favorable outcomes.⁸ Ray et al reported 24 children undergoing the Frey procedure, with 91% remaining pain-free during follow-up and no in-hospital mortality.⁹ Subsequent long-term data from the same group supported sustained pain relief and preservation of endocrine and exocrine pancreatic function.¹⁰ The present series is consistent with these observations, with improvement in pain and quality of life documented during follow-up.

An important technical observation in our series was the successful completion of the Frey procedure in a child with a markedly atrophic pancreas and a main pancreatic duct measuring less than 2 mm, associated with splenic vein thrombosis and left-sided portal hypertension. The presence of collateral vessels and dense peripancreatic adhesions increased operative complexity and prolonged the procedure to approximately six hours. Nevertheless, the duct was successfully identified from the pancreatic head after adequate coring, allowing completion of pancreatic drainage. This experience suggests that a small duct, although technically challenging, should not by itself be considered an absolute contraindication to the Frey procedure in carefully selected children.

The postoperative complications in this series were managed conservatively. One child developed a pancreatic fistula requiring prolonged drainage, while another developed transient blood-stained drain output without a fall in hemoglobin or evidence of an aneurysm on CT angiography. A late intrapancreatic lower common bile duct stricture occurred three years after surgery in one patient and was successfully managed with PTBD after failed ERCP. At six years of follow-up, the patient remained asymptomatic.

The findings should be interpreted in the context of the limitations of a small retrospective case series. The number of patients was limited, follow-up duration was heterogeneous, and standardized prospective assessment of pain, endocrine and exocrine function, and quality of life was not available for every patient. The experience therefore cannot establish comparative effectiveness or define the optimal timing of surgery. Nevertheless, the series contributes to the limited pediatric literature and highlights practical technical considerations in young children, particularly those with minimally dilated ducts and portal hypertensive collaterals.

CONCLUSION

Pediatric chronic pancreatitis is an uncommon but debilitating condition, with recurrent abdominal pain and impaired quality of life being important indications for

surgical intervention. In this six-patient case series, the Frey procedure was feasible across a range of pancreatic duct morphologies, including dilated and minimally dilated ducts, and was associated with improvement in pain and quality of life during follow-up.

A notable finding was the successful performance of the procedure in a child with a markedly atrophic pancreas, a pancreatic duct measuring less than 2 mm, splenic vein thrombosis, and left-sided portal hypertension. Despite the technical difficulty, adequate pancreatic head coring and ductal drainage were achieved. Postoperative complications, including pancreatic fistula and transient blood-stained drain output, were managed conservatively, while a late biliary stricture was successfully treated with percutaneous biliary drainage.

Overall, the Frey procedure represents a feasible organ-preserving surgical option for carefully selected children with chronic pancreatitis and debilitating recurrent pain, including those with challenging pancreatic anatomy and small-duct disease. Larger multicentre studies with standardized long-term assessment of pain, pancreatic function, quality of life, and nutritional outcomes are required to further define its role.

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