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RESEARCH ARTICLE

Effectiveness of pancreatic stent placement in pediatric patients with acute recurrent and chronic pancreatitis

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Abstract

Background: *The use of pancreatic prostheses in children with acute recurrent pancreatitis (ARP) and chronic pancreatitis (CP) has evolved. The main established indication is the treatment of persistent abdominal pain. This study aimed to evaluate the efficacy of pancreatic stenting for refractory abdominal pain in pediatric patients with ARP and CP.* **Methods:** *We conducted a retrospective case series study. We included patients under 16 years of age diagnosed with ARP and CP in the study. Endoscopic retrograde cholangiopancreatography (ERCP) was performed with the insertion of one and later two pancreatic stents. We evaluated abdominal symptoms before and after treatment, number of changes, duration of treatment, and complications with follow-up at 24 months and after withdrawal.* **Results:** *Nine patients with ARP and CP were included in the study: six with undetermined etiology and three with pancreas divisum. The mean age was 12.4 years. Prosthesis placement relieved abdominal pain in 100% of cases, with 3.2 replacement sessions every 6.2 months for 27.4 months, and mild complications (15.7%). One patient experienced pain on removal of the prosthesis and required bypass surgery.* **Conclusion:** *Pancreatic stent placement in patients with refractory abdominal pain with ARP and CP proved to be effective and safe, providing medium-term symptom relief and minimal complications.*

Keywords: *Pancreas divisum. Chronic pancreatitis. Pediatrics. Pancreatic prosthesis.*

Eficacia de la prótesis pancreática en pacientes pediátricos con pancreatitis aguda recurrente y crónica

Resumen

Introducción: *El uso de prótesis pancreáticas en niños con pancreatitis aguda recurrente (PAR) y crónica (PC) ha evolucionado. La principal indicación establecida es el tratamiento del dolor abdominal persistente. El objetivo de este estudio fue evaluar la eficacia del uso prótesis pancreática para el dolor abdominal refractario en pacientes pediátricos con PAR y PC, sin respuesta a manejo conservador.* **Métodos:** *Se llevó a cabo un estudio retrospectivo de serie de casos. Se incluyeron pacientes menores de 16 años con diagnóstico de PAR y PC. Se realizó una colangio pancreatografía retrograda endoscópica (CPRE) para introducir inicialmente una y posteriormente dos prótesis pancreáticas. Se evaluaron síntomas*

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abdominales antes y después del tratamiento, número de recambios, duración del tratamiento y complicaciones con seguimiento a 24 meses y posterior a su retiro. **Resultados:** *Se incluyeron 9 pacientes con PAR y PC: seis de etiología no determinada y tres con páncreas divisum. La edad promedio fue de 12.4 años. La colocación de prótesis alivió el dolor abdominal en el 100%, con 3.2 sesiones de recambio cada 6.2 meses en 27.4 meses, y complicaciones leves (15.7%). Un paciente presentó dolor al retirar las prótesis y requirió cirugía derivativa.* **Conclusiones:** *El uso de prótesis pancreática en pacientes con dolor abdominal refractario con PAR y PC demostró ser eficaz y seguro al aliviar los síntomas a mediano plazo con mínimas complicaciones.*

Palabras clave: *Pancreatitis crónica. Páncreas divisum. Pediatría. Prótesis pancreática.*

Introduction

Pancreatitis has been classified as acute pancreatitis (AP), acute recurrent pancreatitis (ARP), and chronic pancreatitis (CP). ARP is defined as at least two distinct episodes of AP with complete resolution of pain or complete normalization of serum pancreatic enzyme levels before a new episode of AP is diagnosed, regardless of the specific time interval between episodes of AP. CP is defined as abdominal pain typical of pancreatitis plus characteristic imaging findings, exocrine insufficiency plus imaging findings, or endocrine insufficiency plus imaging findings[1-3]. The causes may be obstructive or non-obstructive. The former include common bile duct cysts, pancreas divisum, annular pancreas, duodenal diverticulum, duodenal duplication, parasitic infection, and anomalies of the pancreaticobiliary junction. Non-obstructive causes include hereditary factors, autoimmune factors, cystic fibrosis, hyperlipidemia, trauma, medications, and hypercalcemia[4-6]. Endoscopic treatment aims to improve abdominal pain and prevent damage of the pancreatic parenchyma and duct, which can lead to exocrine and endocrine pancreatic complications[7].

In recent years, endoscopic therapy has become a widely used primary treatment option for patients with abdominal pain due to a variety of pancreatic disorders, including ARP, CP, pancreatic duct leakage or disruption (pancreas divisum), pseudocyst drainage, and prevention of pancreatitis after endoscopic retrograde cholangiopancreatography (ERCP)[7,8]. One of the most common forms of pancreatic endotherapy is sphincterotomy and pancreatic stent placement. These are placed in the main pancreatic duct to relieve ductal obstruction, often in refractory abdominal pain due to strictures, stones, or papillary stricture. They have also been used in the minor papilla to treat symptomatic pancreas divisum secondary to a stenotic minor papilla[8].

The purpose of this study was to evaluate the efficacy of using a pancreatic prosthesis to reduce pain in pediatric patients with ARP and CP.

Methods

We conducted a retrospective case series study from July 2013 to December 2021. The study was descriptive and observational. We included consecutive cases of children aged 6-16 years diagnosed with ARP and CP confirmed by clinical presentation and imaging studies, who persisted with abdominal pain despite medical treatment and whose clinical records had complete information. Medical treatment included a diet without cholecystokinetics, analgesics, and proton pump inhibitors.

Of the 14 patients who met the inclusion criteria, five were excluded due to incomplete records, loss of follow-up, or failure to achieve 24 months of follow-up from baseline.

We evaluated variables such as age, sex, number of episodes of pancreatitis before the endoscopic intervention, indication for pancreatic prosthesis placement, prosthesis replacement time, number of replacements, pancreatic duct diameter at baseline and at removal, complications, and clinical evolution after prosthesis removal. As part of the medical management, patients were prescribed a diet without cholecystokinetics and analgesic treatment for pain.

Before prosthesis placement, magnetic resonance cholangiopancreatography was performed to evaluate the presence of anatomical abnormalities, stenosis, stones, and pancreatic duct caliber. Subsequently, ERCP was performed to cannulate the pancreatic duct with a triple lumen sphincterotome; after the passage of the hydrophilic guide, a 3 mm sphincterotomy was performed, and a pancreatic prosthesis of 5 or 7 French of diameter by 5 or 7 cm length was placed, depending on the characteristics of the duct.

After placing this prosthesis, patients were followed up after 1 month to observe the clinical evolution, then every 6 months for prosthesis replacement, and after 24 months to evaluate the diameter of the pancreatic duct. Two prostheses were placed according to the diameter of the duct for better drainage.

The procedure was performed by a team of experienced pediatric endoscopists using adult duodenoscopes (TJF TYPE 160VF Olympus Tokyo Japan and ED530XT Fujifilm Corporation Japan), a triple lumen sphincterotome (Wilson-Cook Medical Inc., Winston-Salem, N.C.), hydrophilic guidewire (Wilson-Cook Medical Inc., Winston-Salem, N.C.), and pancreatic prosthesis (Wilson-Cook Medical Inc., Winston-Salem, N.C.).

All procedures were performed under general anesthesia by an experienced pediatric anesthesiologist. Procedures were performed in the radiology department, limiting fluoroscopy time with minimal radiation exposure and covering the patients' genital organs. Ultravist 300 (Bayer AG Germany) 50% contrast was used to visualize the diameter of the affected duct; pancreatic duct measurements were obtained at the beginning and end of the study.

Ethical aspects

Following the Declaration of Helsinki, the study was approved by the hospital's Health Research and Ethics Committee under number HIM-SR-2021-022.

Statistical analysis

A descriptive analysis was performed. The Shapiro–Wilk test was performed for quantitative variables, a non-parametric distribution was shown, and values were described as medians, minimums, and maximums. Frequencies and percentages were used for qualitative variables. STATA version 11 was used.

Results

Nine patients were included in the study: five females (56%) and four males (44%). The median age was 12.4 years, ranging from 9 to 16 years. Cholangiopancreatography showed pancreatic duct dilatation of 3 mm in two, 4 mm in three, and 5 mm in four patients. In six cases (67%), no etiology was found, so they were considered idiopathic after the studies. In three cases (33%), an anatomical alteration (pancreas divisum) was found (Table 1). The main symptom in all cases was pain associated with elevated serum levels of pancreatic enzymes. Before study entry, patients had a median of 4.5 pancreatitis events (minimum 3 and maximum 7). The median follow-up period was 28 months (minimum 24 and maximum 40 months). Some patients had prolonged follow-up due to conditions that delayed prosthesis replacement: two patients were delayed because scheduled surgical procedures were suspended during the COVID-19 pandemic, and one adolescent became pregnant during follow-up and underwent postpartum replacement.

A total of 43 procedures were performed, with a median of five per patient (range 4-6), including placement, replacement, and removal of the prosthesis. The replacement frequency was every 6.2 months (range 1-8 months); there was only one case where replacement had to be performed after 1 month due to obstruction of the prosthesis with pancreatitis, requiring the placement of a double prosthesis. The replacements performed between 7 and 8 months were due to the inactivity of the institution on the scheduled date due to the COVID-19 pandemic.

After 2 years of treatment or more than three exchanges, all nine patients had their prostheses removed. Eight patients (88.8%) remained asymptomatic 6 months after prosthesis removal. Three of them (33%) reached 18 years of age and were referred asymptomatic to an adult hospital for further follow-up. The remaining five patients (56%) are still under clinical follow-up; four have been asymptomatic for 12, 26, 27, and 32 months. The last patient required surgical treatment for pain relief 5 months after removal and was referred to an adult hospital for follow-up at age 18, remaining asymptomatic to date.

When the prostheses were removed, the diameter of the ducts increased (5 mm in one, 6 mm in two, 7 mm in one, and 8 mm in five). During the first year of the study, two patients had mild pancreatitis, one had two episodes, and the rest had no pain.

Complications reported after ERCP, sphincterotomy, prosthesis placement, prosthesis replacement, or removal were mild AP in seven patients (15.7%) after 43 procedures; one patient had migration of the intraductal prosthesis (2%), which was successfully removed and repositioned with an endoscopic balloon.

Discussion

Pain caused by pancreatitis (mainly ARP and PC) is a prominent and often debilitating symptom that usually does not disappear in the natural course of the disease; its mechanism may be because intraductal hypertension due to its obstruction. Initially, these conditions had to be treated by a specialist, but if the patient did not respond, or got complicated, surgery was necessary.

Table 1. Description of the nine patients after pancreatic prosthesis placement

Case	Age/sex	ERCP/ prosthesis used	Months of treatment	Complications	Post-removal follow-up (months)	Type of pancreatitis	Clinical manifestations	Previous pancreatitis	PD start body/tail	PD final body/tail	Therapeutic success
1	Female 11 years	5/5	26	Pancreatitis post-ERCP and pain	5	ARP pancreas divisum	Pain Surgery Age-related discharge	4	3 mm/2 mm	8 mm/4 mm	No
2	Female 11 years	6/8	40	Pancreatitis post-ERCP Intraductal migration	36	CP idiopathic	Asymptomatic	7	4 mm/2 mm	8 mm/3 mm	Yes
3	Male 16 years	4/4	24	Pancreatitis post-ERCP	6	CP idiopathic	Asymptomatic Age-related discharge	5	5 mm/3 mm	6 mm/4 mm	Yes
4	Female 16 years	4/4	31	Pancreatitis post-ERCP	6	CP idiopathic	Asymptomatic Age-related discharge	4	5 mm/3 mm	8 mm/5 mm	Yes
5	Male 13 years	5/6	34	No	4	CP idiopathic	Asymptomatic	5	5 mm/3 mm	8 mm/3 mm	Yes
6	Male 11 years	4/4	27	Pancreatitis post-ERCP	26	ARP pancreas divisum	Asymptomatic	3	4 mm/2 mm	5 mm/2 mm	Yes
7	Male 16 years	5/6	24	No	2	ARP idiopathic	Asymptomatic Age-related discharge	4	4 mm/2 mm	6 mm/3 mm	Yes
8	Female 9 years	5/6	24	No	12	ARP idiopathic	Asymptomatic	6	3 mm/2 mm	8 mm/3 mm	Yes
9	Female 9 years	5/7	26	Pancreatitis post-ERCP	27	CP pancreas divisum	Asymptomatic	3	5 mm/3 mm	7 mm/4 mm	Yes

ARP: acute recurrent pancreatitis; CP: chronic pancreatitis; ERCP: endoscopic retrograde cholangiopancreatography; PD: pancreatic duct.

Currently, with the advent of therapeutic ERCP, we have an intermediate treatment[9,10].

Endoscopic therapy has become a widely used primary treatment option for patients with abdominal pain secondary to pancreatic changes in adults[11-13]. However, its detractors mention that the prosthesis produces a reaction with increased duct volume and fibrosis, especially when applied to a duct of normal caliber[14,15]. Some studies suggest that abdominal pain does not usually go away with this treatment[15]; in contrast, several reports in children suggest that this therapeutic approach can be performed safely and provide short-term relief of symptoms[16-18].

In a 12-year study, Güitrón-Cantu et al.[19] included 20 pediatric patients with ARP treated with sphincterotomy (70%), placement of a 7 French caliber pancreatic prosthesis (90%), and replacement with a 10 French prosthesis (50%) every 4-6 weeks, for a total of 35 procedures (average 1.7 sessions) at 24 months follow-up. A non-serious complication rate of 5.7% was reported, with a reduction in the severity and frequency of pain after the procedure; only one patient required bypass surgery. In contrast, we had less cases in a longer period, and we performed sphincterotomy, placement, and replacement with smaller caliber prostheses (5-7 French each), for a longer time and number of replacement sessions. Regarding complications, although we reported a higher percentage (15.7%) without mortality, pain relief and lack of response to treatment were similar.

Lans et al.[20] reported prosthesis replacement every 3 or 4 months, with retention for 1 year and clinical improvement in 90%. Thus, a good clinical response was observed in these three studies (89-94%) despite having different prostheses caliber, distinct replacement times, and duration of treatment. This response was related to adequate drainage of the pancreatic duct. In addition, a low rate of non-serious complications was observed here (5.7% vs. 15%), consistent with Johanson et al.,[21] who reported intraductal migration of the prosthesis as a complication in 5.2% vs. 1.7% in our study. Finally, Kohoutova et al.[18] performed therapeutic ERCP with prosthesis placement in children with CP with a complication rate of 3%.

Regarding the persistence of symptoms after endoscopic treatment, Güitrón-Cantu et al.[19] reported 5% (compared to 11.1% in our series) that ended up in derivative surgery with subsequent improvement, showing that both endoscopic and surgical procedures allow for clinical improvement[5].

Therefore, we consider that pancreatic prosthesis placement by ERCP is a reproducible technique. It has the advantage of being an advanced and minimally invasive endoscopic procedure with a low percentage of complications, promoting a reduction in hospital stay and faster recovery. This technique contributes palliatively to the improvement of abdominal pain in appropriately selected children and as a bridge to surgery in those who do not improve. Due to the small sample size of our study, however, the results presented should be taken with caution.

In pediatric patients with ARP and CP and refractory abdominal pain, pancreatic prosthesis placement is effective and safe in relieving symptoms in the medium term (24 months) with minimal complications.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. This study involved a retrospective review of medical records, for which approval was obtained from a formally constituted review board (Institutional Review Board or Institutional Ethics Committee).

Conflicts of interest

The authors declare no conflicts of interest.

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