# Pancreatic Pseudocyst Following Spinal Surgery: Always Think About It—A Case Report

*Ann. Ital. Chir.*, 2025: 1–6

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AIM: To report the conservative management of a pancreatic pseudocyst (PP) following spinal surgery for neurogenic scoliosis in a pediatric patient.

CASE PRESENTATION: A 12-years-old girl presented with spinal arthrodesis and lumbar fixation for neurogenic scoliosis secondary to cerebral palsy (CP). On postoperative day 11, abdominal computed tomography (CT) showed accumulated fluid (74 × 52 mm) extending along the greater gastric curvature, from the left liver lobe to the anterior abdominal wall.

RESULTS: The fluid was percutaneously drained. The fluid contained a high concentration of amylase; therefore, a diagnosis of PP was made. After 23 days, the symptoms progressively resolved, and the accumulated fluid disappeared. Gastrointestinal complications following spinal surgery in patients with CP are reported in 5%–55% of cases; among these, PP is extremely rare. Pancreatic postoperative ischemia or pancreatic iatrogenic trauma are possible causes of PP formation. In our case, conservative management was safe and effective.

CONCLUSIONS: In patients with persistent postoperative abdominal symptoms following spinal surgery, pancreatic complications should be ruled out. If PP is diagnosed, conservative management is recommended, particularly in young patients with a poor general condition.

**Keywords:** pancreatic pseudocyst; neurogenic scoliosis; cerebral palsy; spinal arthrodesis; case report

## Introduction

A pancreatic pseudocyst (PP) is a clearly defined fluid collection with high concentrations of amylase and pancreatic enzymes surrounded by a wall of fibrous tissue that is not lined by epithelium [1]. The formation of PP in adults is commonly observed after an episode of acute pancreatitis, which is typically alcohol-induced; however, in pediatric patients, PP is often the result of blunt trauma [2,3].

Regardless of the cause, PP can communicate with the pancreatic duct system or parenchyma due to ductal disruption or acute pancreatitis. Six weeks after onset, a PP is considered mature. When its major axis is greater than 6 cm, resolution using conservative medical management is rare [3]. Different strategies of PP management have been described, including percutaneous drainage of the cyst, internal drainage using transpapillary stenting, and open/endoscopic or laparoscopic cyst gastrostomy [4].

*Submitted: 10 October 2024 Revised: 8 November 2024 Accepted: 10 December 2024 Published: 20 March 2025*

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Scoliosis is the presence of a lateral curvature of the spine of >10° on anteroposterior radiography, which is generally associated with abnormal angulation in the sagittal plane and abnormal rotation in the transverse plane. Idiopathic scoliosis (IS) is the most common cause of scoliosis in pediatric patients, accounting for >80% of cases [5]. Other causes include congenital scoliosis (CS), neuromuscular scoliosis (NMS), secondary conditions related to connective tissue anomalies (e.g., Marfan syndrome and Ehlers-Danlos syndrome), osteochondrodystrophy, and tumors [5].

The indications for surgical treatment depend on the scoliosis type, patient age, curvature severity, and Risser grade. Risser grades indicate the skeletal maturity of the child; in particular, Risser grades 0 and 1 indicate rapid growth and skeletal immaturity, whereas Risser grades 4 and 5 indicate stopped growth and skeletal maturity [6]. In the particular case of NMS, spinal deformity in patients with cerebral paralysis (CP) continues to worsen during skeletal maturity and is thought to be associated with muscular imbalance around the spinal axis due to spastic or flaccid muscle weakness [7]. Surgery is recommended for CP if a curve of ≥50° develops, especially when it compromises functional sitting, or in patients in whom CP progresses beyond skeletal maturity [5,8].

Surgical complications after spinal surgery are common in patients with CP, occurring 17–68% of cases. Respiratory, gastrointestinal, neurological, and infectious complications have been observed, together with implant-related complications and pseudarthrosis [8,9]. Among gastrointestinal complications, pancreatitis, hyperamylasemia, pancreatic fracture, gastrointestinal bleeding, appendicitis, cholecystitis, intestinal ischemia, and retroperitoneal lymphocele have been reported [10–12]. The present report describes a rare case of PP formation as a complication of spinal surgery for NMS in a patient with CP who was managed with conservative treatment. This case has been reported in line with the Case Report (CARE) Guidelines to ensure the accuracy and completeness of the report (**Supplementary material**).

## Case Report

*Patient History*

A 12-year-old female with CP, epilepsy, and NMS underwent spinal arthrodesis with lumbar fixation at another hospital. The patient had no history of abdominal pain or pancreatitis. She had gastroesophageal reflux (GER) that was managed with medical treatment. She had no history of drug or food allergies. The patient had never undergone any previous surgery.

Spinal surgery was indicated following progressive worsening of scoliosis. The initial postoperative course was uneventful. The patient received preoperative antibiotic prophylaxis with cefazolin (30 mg/kg), and surgery was performed under general anesthesia with regular extubation at the end of the procedure.

On the third postoperative day, the patient developed generalized edema associated with a distended abdomen and paralytic ileus. Urgent computed tomography (CT) revealed bilateral pleural effusion, free abdominal fluid in the pelvis, and subcutaneous soft tissue edema. Therefore, the patient was transferred to the intensive care unit.

*Clinical, Radiological, and Laboratory Findings at Presentation*

The clinical condition was poor at admission, with an arterial blood pressure of 115/85 mmHg, a pulse rate of 139 beats/min, and an oxygen saturation of 93% on room air. Her temperature was 38.5 °C. She weighed approximately 20 kg.

The patient manifested decreased breath sounds with bilateral rhonchi. Upon inspection, the abdomen was distended, with diffuse tenderness on superficial and deep palpations. Bowel sounds were absent. Increased white blood cell counts (WBCc) 27 $\times$ $10^3$/µL and C-reactive protein (CRP; 120 mg/dL) levels were documented.

Intravenous antibiotic therapy with piperacillin tazobactam (1.2 g every 8 h), amikacin (400 mg every 24 h), and vancomycin (200 mg every 6 h) was started, along with supplementation with albumin and spironolactone (50 mg every 12 h) and furosemide (initially 20 mg/day and then reduced to 7.5 mg every 12 h) infusion, leading to a progressive reduction in the generalized edema and improvement of the general condition.

*Diagnosis*

On postoperative day 11, due to persistent abdominal distension associated with biliary-stained gastric residue, a repeat CT scan was performed to rule out other possible causes of intestinal obstruction.

An irregular area of fluid collection (74 $\times$ 52 mm) extended along the greater curve of the stomach towards the anterior border of the left liver lobe (Fig. 1).

Because of this new finding, extrinsic compression of the upper Gastro intestinal (GI) tract was suspected. This hypothesis was confirmed using upper GI endoscopy (EGDS).

*Treatment*

Therefore, ultrasound (US)-guided percutaneous drainage of the collected fluid was planned, to resolve the obstruction and examine the fluid content. Increased levels of amylase (31.314 UI/L) and pancreatic lipase (101 U/L) were observed. A 6 Fr pigtail catheter was placed in the cavity (Flexima Drainage Catheter, 6Fr-20cm, M001271280, Boston Scientific, Marlborough, MA, USA). Serum amylase levels were also elevated (149 U/L).

Based on the chemical and physical profiles of the drained fluid, radiological images, and high blood amylase levels, an intra-abdominal abscess was ruled out, and a PP was diagnosed. Following the diagnosis of PP, intravenous somatostatin (480 µg/day) and metronidazole (150 mg every 8 h) were administered.

The daily volume of drained fluid progressively decreased during the following 3 weeks, and the drainage was removed 23 days after its placement. Millimetric residual collection was evident on the US examination before the removal (Fig. 2).

*Follow-up*

The patient was discharged 24 days after the drain placement. Her temperature was 35.7 °C, with a pulse of 85 beats/min, arterial blood pressure of 123/90 mmHg, and oxygen saturation of 98% in room air. The WBCc (9.36 $\times$ $10^3$/µL) and serum levels of amylase (68 U/L) and lipase (35 U/L) were normal. She had an uneventful recovery.

The patient underwent periodic checkups in the Pediatric Neuropsychiatry Department. No abdominal pain, episodes of intestinal subocclusion, elevated amylase or lipase levels, or US findings consistent with PP formation were found at the 6-year follow-up.

## Discussion

Gastrointestinal complications following spinal surgery in patients with CP have been reported in 5%–55% of cases. This variability may be due to the variable protocols in dif-

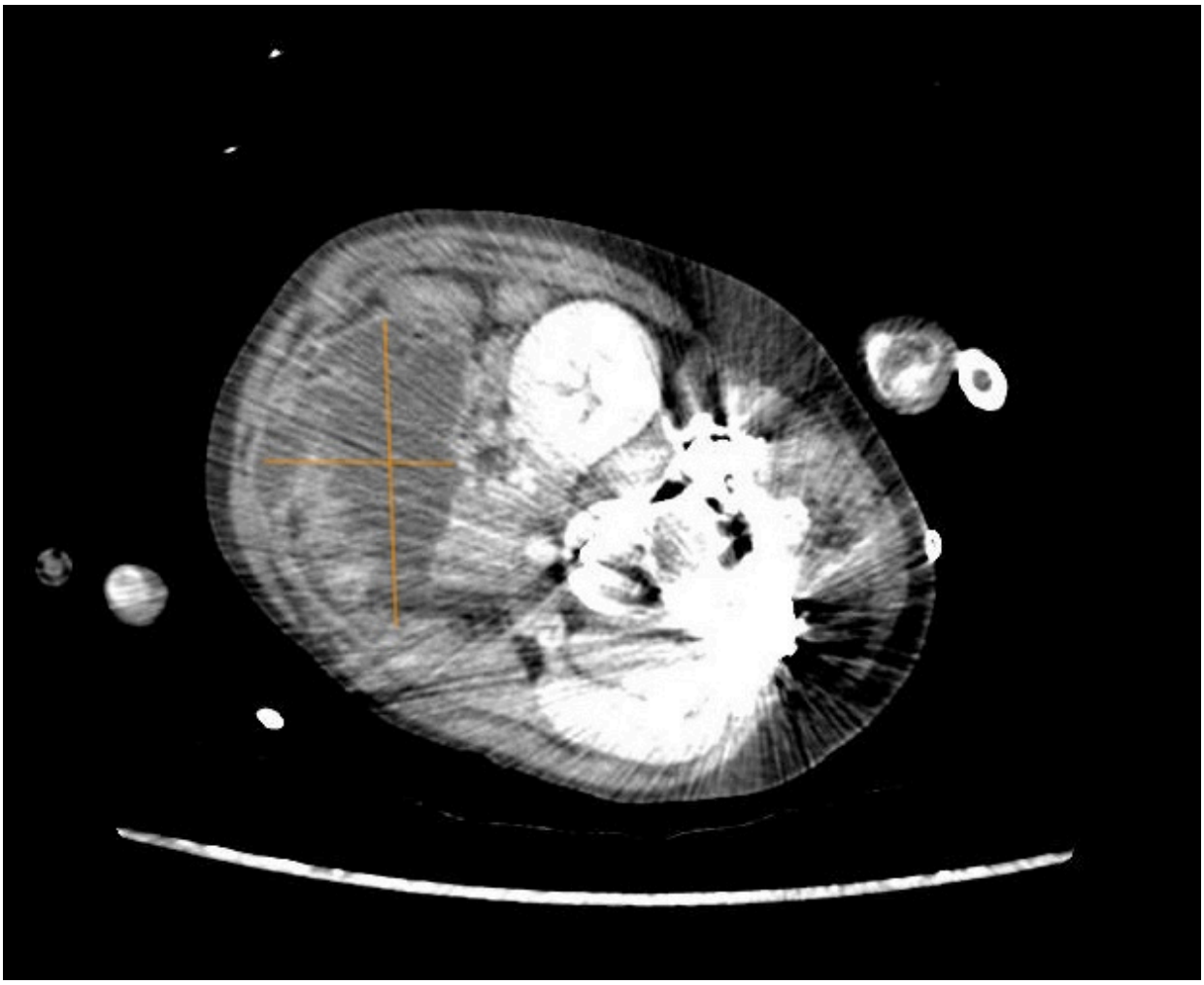

**Fig. 1. Computed tomography (CT) scan.** An irregular area of fluid collection (74 × 52 mm) extended along the greater curve of the stomach towards the anterior border of the left liver lobe (collection size is marked with orange lines).

ferent hospitals, patient heterogeneity, and variable diagnostic criteria [13]. A recent multicenter pediatric study involving 425 children with CP reported that the incidence of GI tract complications after spinal surgery was as high as 16.2% [13].

Our report describes a case of abdominal fluid collection after spinal surgery. Differential diagnoses may include postoperative hematoma, purulent collection, retroperitoneal lymphocele, biliary collection, urinoma, or spinal fluid leak with pseudomeningocele [12,13]. The radiological features, drainage quality, and elevated blood amylase and lipase levels supported the diagnosis of PP.

To our knowledge, cases of PP following pediatric spinal surgery are extremely rare, with only two cases reported in the literature [11,14]. Juricic *et al.* [11] described a 14-year-old patient with CP whose postoperative course was complicated by a jejunal perforation associated with a high-grade pancreatic fracture associated with PP. The patient underwent laparotomy with intestinal resection and conservative management of the pancreatic injury, which consisted of drainage of the PP with gastrocystostomy [11].

Specific intraoperative patient positions and the degree of vertebral rotation are factors that may expose the upper abdomen to manipulations that can lead to iatrogenic pancreatic fracture [13,15]. Ghisi *et al.* [15] reported that pancreatic compression during spinal surgery may occur more frequently in patients with a lower body mass index (BMI) Fewer adipose tissues surrounding the pancreas can lead to greater compression of the parenchyma against the vertebral column, causing more severe trauma. The resulting rupture of the pancreatic duct leads to the formation of PP [15].

Although pancreatic trauma is a complication of other types of upper GI surgeries, it is not the only cause of postoperative pancreatic complications [16]. Borkhuu *et al.* [14] reported a second pediatric case involving a 12-year-old patient with CP. Neither the PP treatment nor etiology was provided in the study, but the causes of acute postoperative pancreatitis were analyzed and reported [14].

Postoperative pancreatitis has been significantly correlated with preoperative GER and the presence of a gastrointestinal feeding tube in patients with CP [14,16]. The same au-

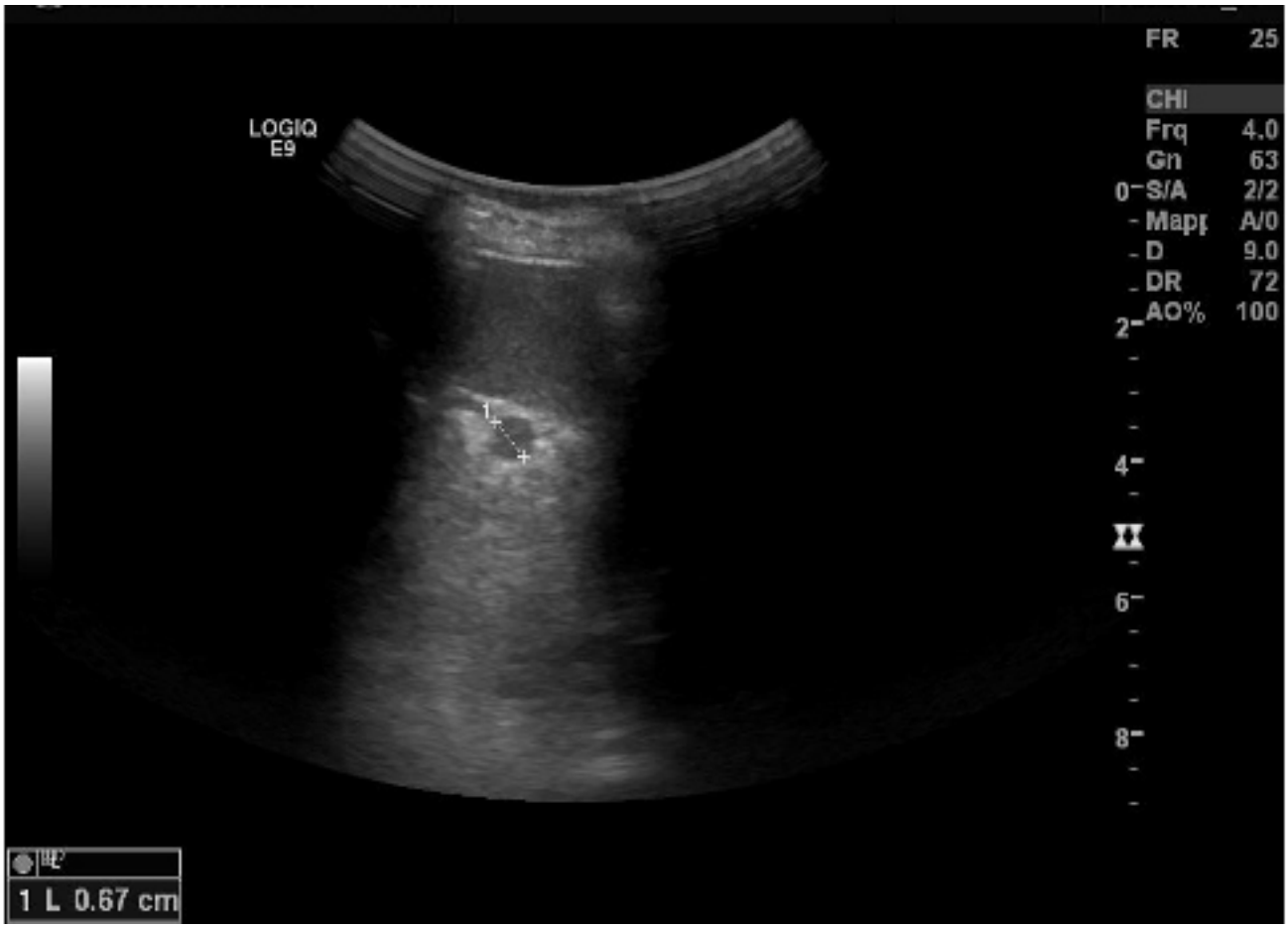


**Fig. 2. Millimetric residual collection was evident on the ultrasound (US) examination before the drain removal (white dot line).**

thors pointed out that an impaired preoperative nutritional status is frequently associated with postoperative pancreatitis in other types of surgeries. However, the cause of this association is not well-understood [14].

A long surgical duration associated with hypotensive anesthesia can lead to pancreatic hypoperfusion and acute pancreatitis postoperatively [13,14,16]. This finding is consistent with acute pancreatitis following other types of abdominal surgeries [17].

Furthermore, although some authors have argued that increased intraoperative blood loss is associated with an increased risk of postoperative pancreatitis [13,16], this correlation has not been demonstrated in other study [14].

A recent systematic review of pediatric patients reported an incidence of 23% for acute pancreatitis secondary to spinal surgery, 2% of which was complicated with PP [16].

In the present case, the PP formation may have been caused mainly by intraoperative pancreatic trauma. Additionally, low BMI and GER may have amplified the effects of iatrogenic trauma.

PP could also have resulted from acute pancreatitis, whose diagnosis was missed because of the lack of routine monitoring of pancreatic functionalities [13,18].

In addition, the poor general condition may have triggered postoperative anasarca, which could have caused hypotension and pancreatitis.

As described above, treatments of PP for pediatric patients can differ [4].

In our case, the conservative approach was preferred for several reasons.

First, the patient's clinical condition, including the underlying pathology, recent surgery, and postoperative catabolic condition, made surgery or endoscopic procedures more complex than normal. Moreover, laparoscopic cystogastrostomy has only been described in a few pediatric cases [4].

Second, the possibility of identifying PP through abdominal US allows for percutaneous drainage with no complications. The large size of the PP and the patient's low BMI facilitated this procedure. If abdominal US visualization of the PP fails, an endoscopic cystogastrostomy can be performed [4].

This paper had limitations concerning the etiology of the condition and its treatment. Due to the rarity of this complication, etiological hypotheses are difficult to demonstrate and are only speculative. Additionally, there is no consensus on the optimal treatment.

In conclusion, our conservative management strategy, comprising antibiotics, somatostatin therapy, and percutaneous drainage of collected fluids, was safe and effective in the management of PP in a fragile pediatric patient.

## Conclusions

We reported a rare case of PP that presented after spinal surgery and was managed with conservative treatment.
We can only speculate on the possible causes of PP formation, such as pancreatic postoperative ischemia or pancreatic iatrogenic trauma.
Monitoring postoperative pancreatic function in this fragile population is crucial for the proper management of pancreatic complications, including PP.
If PP is diagnosed, conservative management should be the first-line treatment, especially in young patients and those with a poor general condition.

## Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Author Contributions

MVS, FVP and LN designed the research study. MVS, RR, SF and SS performed the research. MVS, RR analyzed the data. MVS and FVP wrote the manuscript. LN, FVP and SS were involved in medical and surgical care of the patient. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

## Ethics Approval and Consent to Participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the Declaration of Helsinki (2013) and its later amendments or comparable ethical standards. Informed consent for the publication of the case report was obtained from the patient's parents. Ethical approval for the study was waived by the Ethics Committee of Policlinico Agostino Gemelli Hospital.

## Acknowledgment

Not applicable.

## Funding

This research received no external funding.

## Conflict of Interest

The authors declare no conflict of interest.

## Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://annaliitalianidichirurgia.it/index.php/aic/article/view/3798.

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