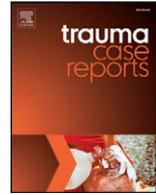




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### Case Report

# Post-traumatic pancreatico-dural fistula: Case report and management challenges☆

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#### ABSTRACT

Pancreatic injury can occur following high-energy blunt trauma to the torso. Although several types of pancreatic fistulas have been described in literature, we report to our knowledge, the first case of a pancreatico-dural fistula of traumatic origin.

A 20-year-old male sustained a severe blow to the thoraco-abdominal region in the setting of a motorcycle accident. A total body scan revealed an AAST (American Association for the Surgery of Trauma) grade 4 splenic injury. A laparotomy with splenectomy and abdominal packing was performed. This was later followed by thoracolumbar instrumentation for posterior fixation of a T11–T12 transdiscal type C fracture with anterior subluxation of T11, according to the AO classification. Subsequent management was complicated by the persistence of a pseudomeningocele despite multiple surgical drainage procedures and a concomitant increase in retroperitoneal fluid collections. High levels of amylase and lipase in the pseudomeningocele fluid confirmed the presence of a pancreatico-dural fistula, due to a Wirsung duct rupture. This case report illustrates the challenges in the management of this rare condition.

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☆ Nothing to be disclosed.

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## Introduction

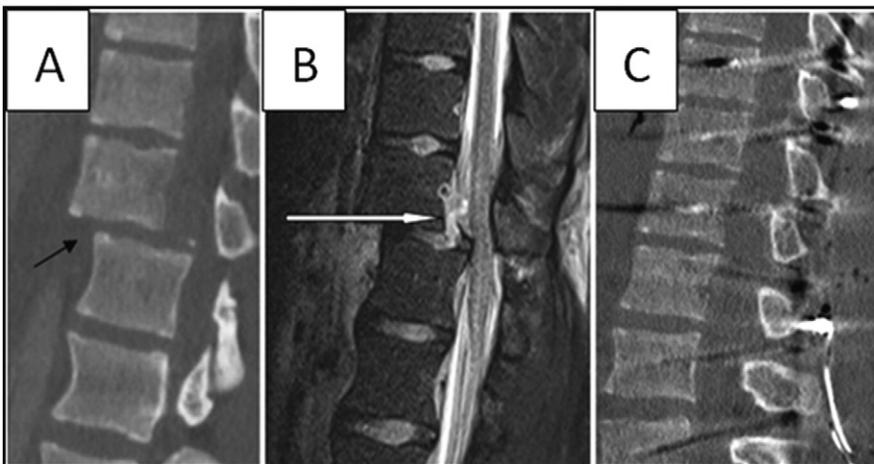
Pancreatico-dural fistula has not been previously reported in the literature. It is due to the rupture of the pancreatic duct, which results in the leakage of proteolytic secretions into the retroperitoneal space. In case of a concomitant spinal injury with a cerebrospinal fluid (CSF) leak, a fistulous connection may develop between the two compartments. The recognition of this complication may be delayed, with potentially severe consequences.

### Case report

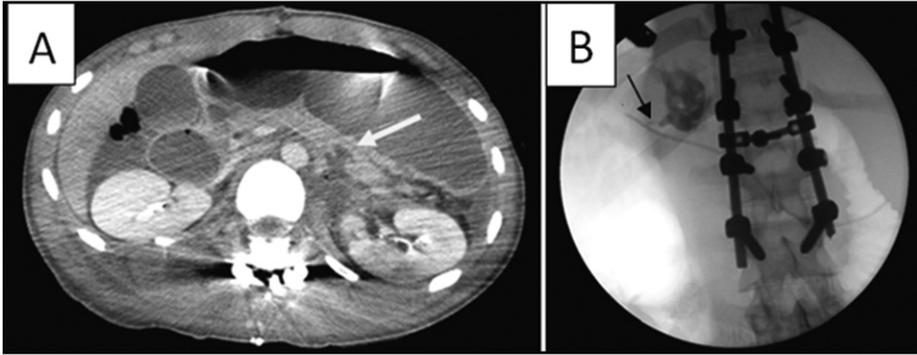
A 20 year old male patient was involved in a motor vehicle accident, driving at a speed of 60 km/h, with resultant severe and diffuse trauma to the abdomen, trunk and extremities. The patient was wearing protective clothing. He was rescued by an experienced air ambulance team and arrived at the emergency department with unstable vital signs, flaccid paraplegia with a cord level at T10 and a complete loss of voluntary control over bowel and bladder function. The FAST examination was negative. A total body CT revealed multiple rib fractures, bilateral hemothoraces, and hemoperitoneum with AAST grade 4 splenic injury [1]. He also had left-sided renal and adrenal injury, in addition to a right-sided scapular fracture. Spinal CT imaging showed a transdiscal AO type C fracture with bilateral facet subluxation of T11 over T12 [2]. The pneumothoraces were drained through chest tubes. An exploratory laparotomy was performed because of hemodynamic instability, and a splenectomy was performed. The left retroperitoneal space was packed due to the presence of a large retroperitoneal hematoma and known kidney and adrenal injuries. "Damage Control" type surgery, without thorough exploration of the pancreas, was performed, due to the patient's compromised physiological status, and no other lesions were identified at that time.

The patient was then transferred to the Intensive Care Unit for close monitoring. On post-admission day (PAD) 1, MRI of the spine was performed, showing the subluxation of T11 over T12, with an associated rupture of the intervertebral disc and the posterior longitudinal ligament. In addition, it revealed a 9 mm-thick epidural hematoma overlying the posterior wall of T11, associated with a medullary contusion at the level of T11–T12 (Fig. 1B).

On PAD 2, spinal surgery was performed, with reduction of the subluxation and trans-pedicular screw fixation from T9 to L2. An intra-operative post-traumatic dural tear was suspected, because of a small leak of CSF, but no repair was attempted because of the impossibility to clearly identify the site of leakage. The liquid was apparently clear and colourless. On PAD 3, a planned second look laparotomy was performed and after depacking, no bleeding was observed, with persistence of the retroperitoneal hematoma. A small



**Fig. 1.** Sagittal CT (A) and MRI (B) images showing the anterior translation of T11 over T12 associated with significant narrowing of the canal diameter at this level. There is also an epidural hematoma located posterior to T11. Image C shows the reduction and posterolateral arthrodesis that was performed.

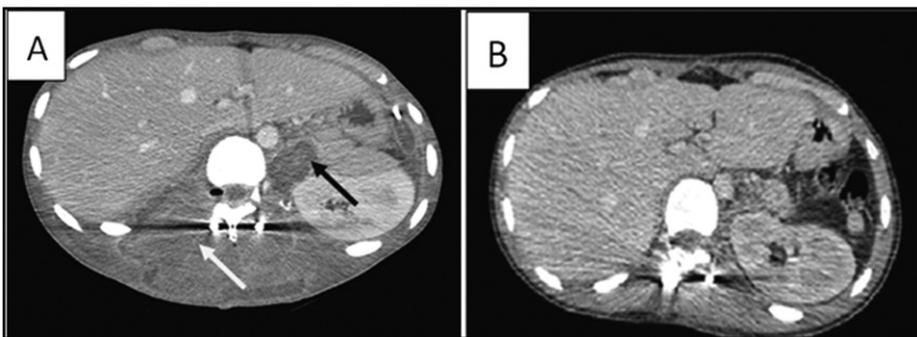


**Fig. 2.** A: AAST grade 3 pancreatic injury (white arrow). B: ERCP with contrast extravasation showing the location of the fistula at the body/tail junction (black arrow). Stenting of the main pancreatic duct with a plastic prosthesis from the duodenum to the pancreatic tail was performed.

amount of turbid liquid was identified, but no lesions were found after inspecting the small intestine and colon.

Over the following days, the patient complained of intense back pain that was not responsive to opiates. He experienced hallucinations, became agitated and developed a septic state. A thoracolumbar MRI and a thoraco-abdominal CT were performed, showing large bilateral para-vertebral and retroperitoneal fluid collections. They also revealed a AAST grade 3 pancreatic injury, which was retrospectively already present on the initial CT, but not recognized at that time [3]. The patient was taken back to the operating room for revision of the thoraco-lumbar wound. During surgery, a CSF leak from a circular dural breach at the level of the previous subluxation was identified. The breached area was then repaired with a fibrin sealant (Tisseel, Baxter International Inc.), along with debridement of necrotic tissue and drainage of newly purulent collections. This was followed by copious irrigation with normal saline and tight closure of the fascia and subcutaneous tissue. Two Penrose drains were left in the superficial layers. The retroperitoneal fluid collections were evacuated by percutaneous CT-guided placement of a drain. The blood cultures, paravertebral and abdominal fluid collections were all positive for *Enterobacter cloacae*. Intravenous antibiotic treatment with Meropenem was instituted. Despite all interventions, the paravertebral and abdominal collections increased and repeat cultures remained positive for *Enterobacter cloacae*. The paravertebral collections exteriorized through the dorsal skin across three new locations other than the incision.

Serum amylase and lipase were measured high up to 3 times the standard norm from the trauma day up to 1 week, then the values returned to baseline (standard norm respectively 13–53 U/l and 13 60 U/l). High levels of amylase (12'716 U/l) and lipase (72'610 U/l) were also found upon chemical analysis of the dorsal spinal fluid collections. In order to treat the pancreatic leak, an ERCP was performed, with placement of a



**Fig. 3.** A: Retroperitoneal (black arrow) and paravertebral (white arrow) collections before placement of the pancreatic duct stent. B: CT at 7 months follow-up showing complete resolution of the pseudomeningocele and the intra-abdominal collections.

stent bridging the defect of the main duct, located in the body of the pancreas (see Fig. 2). The patient required a reoperation for debridement and drainage of the recurrent paravertebral collection and reapplication of a layer of fibrin sealant over the dural breach.

The patient was initially exclusively fed by total parenteral nutrition for a period of 15 days. Subcutaneous somatostatin was introduced for a period of 7 days (0.1 mg tid), as an adjunct to proton pump inhibitors, to minimize pancreatic secretions. A progressive enteral feeding by naso-jejunal tube in addition to parenteral alimentation was continued for 7 days. The patient could then gradually be orally fed and enteral and parenteral nutritional intake could be weaned off. Over the following weeks, the patient's general condition slowly improved, with progressive resolution of all fluid collections on serial follow-up CT. The drains were removed and the patient transferred to a rehabilitation facility on PAD 52, with a neurologic status of complete paraplegia and a sensory level at T10. Antibiotic treatment was given for a total of 7 months till the CT showed complete resolution of the collections in the spinal and retroperitoneal spaces (Fig. 3B).

## Discussion

Intraabdominal injury is present in almost 50% of patients with thoracolumbar fractures [4]. The main associated lesions are hollow viscus and mesenteric injuries, followed by solid organ injury, resulting from rapid deceleration with resultant shearing stress. An important predictor for the presence of a significant abdominal injury is the combination of a thoracolumbar fracture and an abdominal wall ecchymosis ("seatbelt sign").

Pancreatic injury has been reported to occur in only 1–5% of patients with blunt trauma, but is associated with a high morbidity (30–62%) and mortality (10–30%) [5]. Injury to the main pancreatic duct occurs in up to 15% of pancreatic trauma. Only 3.6% of patients with injury to the main duct will eventually develop a pancreatic fistula [6]. The diagnosis is difficult and delay in treatment is therefore frequent [7]. A normal serum lipase result can be a useful adjunct to exclude pancreatic injury. A positive lipase result, regardless of the cut-off used, is not reliably associated with pancreatic trauma, and should not be used to guide assessment [8]. The part of the pancreas usually injured is situated to the left of the superior mesenteric vessels [9]. Different types of pancreatic fistulae have been described, including communication with peritoneal, pleural, pericardial and ureteral epithelium [10–13]. In this report, we describe the first case of pancreatoco-dural fistula. If there is complete disruption of all elements of the spinal column and the posterior abdominal wall, as in our case, the retroperitoneal space becomes continuous with the spinal compartment. With a concomitant injury to the main pancreatic duct, leakage of proteolytic enzymes into the spinal canal becomes thus possible and a pancreatoco-dural fistula can develop. A possible reason why this specific complication had not been previously reported could be the fact that the severity of the trauma leading to these ruptures is of such intensity that patients either do not survive or have a poor outcome despite a correct diagnosis. It may therefore occur publication bias, with unpublished negative results.

Pancreatic fistulae can be managed in different ways. The non-operative management involves image-guided drainage, fluid management and nutritional support. In a prospective study, 90% of post-traumatic pancreatic fistulae closed spontaneously in less than a month with this approach [14]. ERCP is the most sensitive modality for detecting pancreatic ductal injury by showing extravasation of contrast medium from the duct system [15]. The procedure can also be therapeutic and pancreatic duct stenting may be attempted to redirect secretions and "dry out" the fistula. In a Finnish retrospective study, the success rate of pancreatic fistula closure after therapeutic ERCP was 82% [16]. Finally, surgical treatment is used as last resort when all radio-interventional and conservative attempts fail. The approach depends on the location of the breach in the pancreatic duct. In case of injury to the body or tail, a distal pancreatectomy may be considered [17]. If the pancreatic head is involved, the safest option is an external drainage. Pancreticoduodenectomy is indicated only if massive lesions involving the pancreas, the duodenum and the common bile duct are present [9].

The patient at discharge had a stable neurological exam with a sensory level of T10. The fact that the damage to the spinal cord didn't extend upward was intriguing. We don't have actually a clear explanation. It might be that the pancreatic secretions were mainly concentrated around the paravertebral space, and that the continuous flow of CSF had a washing and dilution effect near the spinal cord that prevented further damage.

This case report emphasizes the importance of the normal anatomic barriers. The severe trauma caused a breach in the main pancreatic duct and a disruption of the para-vertebral soft-tissues, with subsequent development of a communication between the retroperitoneal and epidural spaces. The proteolytic nature of the pancreatic secretions may have contributed to the development and progression of the fistulous connection. In our case, the presence of pancreatic secretions and thus proteolytic digestion might have in retrospect been recognized earlier, since the posterior effluents were turbid, CSF being universally clear in appearance. But the presence of infection made the differentiation difficult, it was only when the secretions eroded through the skin when we started searching for alternative hypothesis. At this time the possibility of an underlying fistula with the pancreatic secretions was evoked. Indeed the review of the initial CT scan confirmed the pancreatic injury, as well as the analysis of the chemical contents of the secretions. Thorough exploration of the pancreas must hence be performed during any trauma laparotomy in order not to miss or delay any significant injury by exposure through the lesser omentum.

CT is currently the imaging modality of choice for pancreatic injury, although the reported sensitivity in detecting pancreatic injury is low, in the range of 47–60% [17]. It is imperative for radiologists to be vigilant for these injuries. Findings of pancreatic trauma on CT are often nonspecific, and high levels of clinical suspicion and understanding of mechanism of injury are important. Familiarity with the grading schemes of pancreatic injury is mandatory because they may directly influence management [18].

Underlying explanation should be searched in patients who have an atypical course following early surgical treatment of spinal and abdominal trauma. Although having pancreatic secretions within the pseudo-meningocele was something we do not think of, the behaviour of the post-operative paravertebral and retroperitoneal collections were very atypical. There was also subsequent formation of conduits from the paravertebral space up across the fascia, subcutaneous layers and eventually through the skin. The ability to diagnose the fistula clinically led to the performance of an ERCP, and subsequently the definitive treatment through the stenting of the duct of Wirsung. Once the pancreatic duct breach was diagnosed and managed, the fistula gradually resolved without the need for further interventions.

## Conclusion

Pancreatico-dural fistula is a rare entity and can have serious complications. A high index of suspicion is necessary to diagnose this condition and should be considered in the setting of a combination of spinal (thoracolumbar) and abdominal trauma, especially when the clinical course is atypical in the post-operative phase. A multidisciplinary approach is clearly required, including surgeons, gastroenterologists and radiologists, so as not to miss initial lesions. Treatment needs to be adapted based on the exact sites of the trauma and the anatomical barriers that have been breached. Prompt identification and adequate multidisciplinary management could result in a good outcome.

## Conflict of interest

The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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