Pancreatic fracture: a rare complication following scoliosis surgery

Mélodie Juricic Jr.[1] · Kalitha Pinnagoda[2] · Walid Lakhal[1] · Jérome Sales De Gauzy[1] · Olivier Abbo[2]

Abstract

Study design Grand Round case report.
Objective We report a pancreatic fracture associated with Wirsung duct disruption, following a scoliosis surgery in a cerebral palsy adolescent.
Summary of background data Spinal fusion surgery is the standard treatment for severe neuromuscular scoliosis. Many complications such as digestive ones account for its complexity. Postoperative acute pancreatitis is well described, although its pathophysiology remains unclear. To our knowledge, pancreatic fracture following scoliosis correction has never been described to date. Clinical presentation is not specific, and management is not consensual.
Case report A 14-year-old adolescent had posterior spinal fusion for neuromuscular scoliosis due to cerebral palsy. During the postoperative course, she developed progressive nonspecific abdominal symptoms. The abdominal CT scan demonstrated a pancreatic fracture and a surgical exploration was decided as perforations of the bowel were highly suspected. Drains were placed around the pancreatic area as the retrogastric region was out of reach due to local inflammation. Conservative management led to the occurrence of a pseudocyst in the following weeks as the pancreatic leakage progressively dropped.
Discussion Two hypotheses have been proposed: direct iatrogenic trauma from lumbar pedicle screws and pancreatic rupture related to the correction of the spinal deformity. As the latter seems the most likely, spinal surgeons should be aware of this occurrence following severe scoliosis correction.
Conclusion Spinal fusion for severe neuromuscular scoliosis is a difficult procedure, with a high rate of complications. Among them, pancreatic fracture should be considered when abdominal pain persists in the postoperative period. Conservative management is advocated especially in case of a poor general condition.

Keywords Scoliosis · Posterior spinal fusion · Pancreatic fracture · Pseudocyst · Cerebral palsy

✉ Olivier Abbo
abbo.o@chu-toulouse.fr

1 Pediatric Orthopedic Department, Hôpital des Enfants de Toulouse, CHU Toulouse, 330, Avenue de Grande Bretagne, 31059 Toulouse Cedex 9, France

2 General Pediatric Surgery Department, Hôpital des Enfants de Toulouse, CHU Toulouse, 330, Avenue de Grande Bretagne, 31059 Toulouse Cedex 9, France

Case presentation

A 14-years-old girl was referred to the spine clinic at our institution for severe neuromuscular scoliosis as a consequence of cerebral palsy following a great prematurity

(30 weeks of gestation). She had a 120° right thoracolumbar curve on preoperative radiographs and was Risser Stage 1 (Fig. 1).

A gastric tube had been inserted months before to improve enteral intake ahead of the spinal procedure. We performed a posterior instrumentation, correction and fusion from T2 to S1 using hybrid implants with screw-hook and sublaminar bands (Fig. 2). Cranial and caudal rods were connected using dominoes to improve the reduction, and achieve spinal balance. The surgical procedure was uneventful as well as the immediate postoperative course. During the first week after the procedure, the patient gradually developed abdominal symptoms including mild abdominal pain, vomiting and abdominal distension despite ceasing any enteral intake. As fever appeared at day 7, biological workup showed an increased lipase blood level (272 U/ml) associated with 27,000/ml white blood cells and C protein-reactive level of 105 mg/l.

Diagnostic imaging section

A CT scan then showed a major intra-peritoneal effusion associated with a suspected jejunal perforation and a corporeal fracture of the pancreas (Fig. 3).

Historical review of the condition, epidemiology, diagnosis, pathology, differential diagnosis

Scoliosis is frequent in cerebral palsy patient with a reported incidence from 4 to 65% [1]. The aims of surgery are to stop the progression and re-balance the spine, therefore, allowing a seated position and facilitated nursing. Surgical correction of neuromuscular scoliosis allows a major benefit from a respiratory and autonomic point of view.

In cerebral palsy, several comorbidities and a major thoracolumbar deformity are often associated, increasing the risk of major complications [2, 3]. In these patients, surgery bears a higher risk of mortality and morbidity, according to data from the scoliosis research society (SRS), with 0.3 and 17.9%, respectively [4].

Not only septic, neurological but also digestive complications are classically described [5]. Among the latter category, some are nonspecific, such as reflex ileus, but others are inherent to the biomechanics of spinal deformity correction (Fig. 3).

The superior mesenteric artery syndrome is the most reported digestive complication of scoliosis surgery, but pancreatic injuries are scarcely described. Studies on acute pancreatitis found prevalence rates ranging between 8.5 and 31% [6, 7]. Pathophysiology remains unclear, but the hypothesis

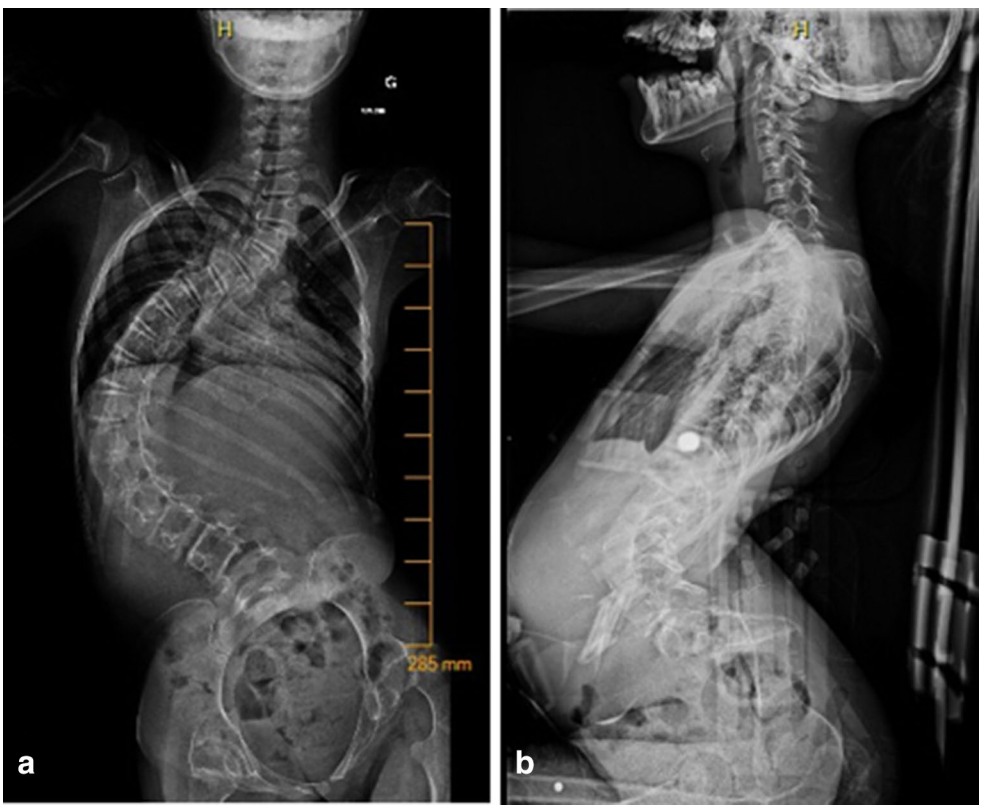

Fig. 1 Preoperative anteroposterior radiograph (**a**) and lateral (**b**) showing a major thoracolumbar scoliosis with pelvic obliquity

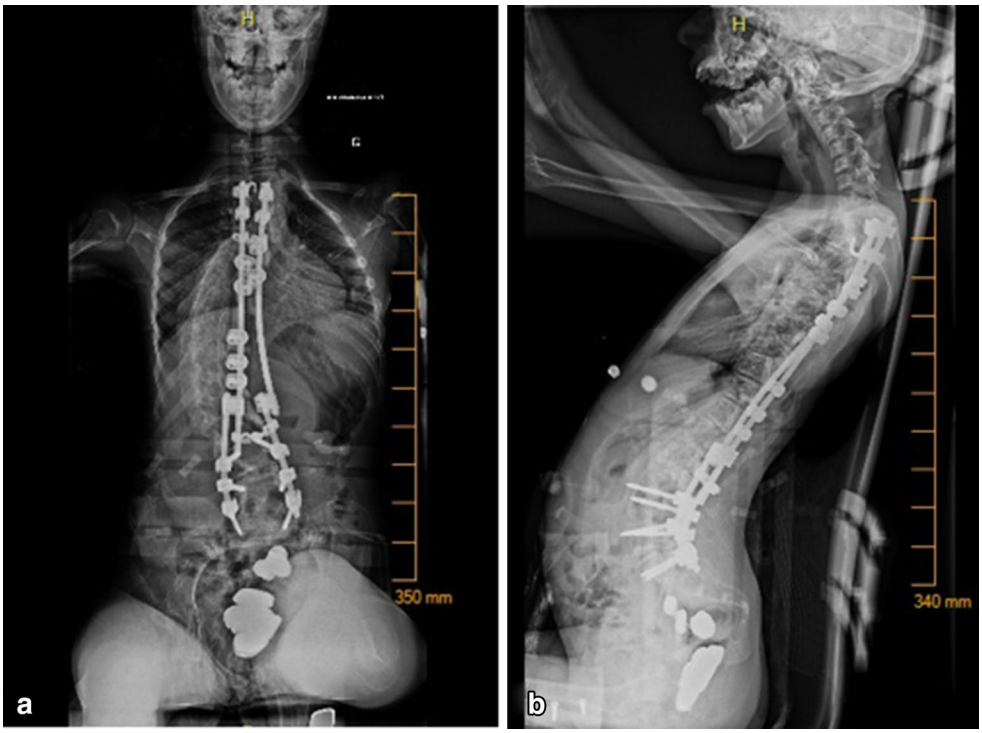

Fig. 2 Postoperative radiograph showing T2–S1 fusion with hybrid instrumentation and a satisfactory curve correction

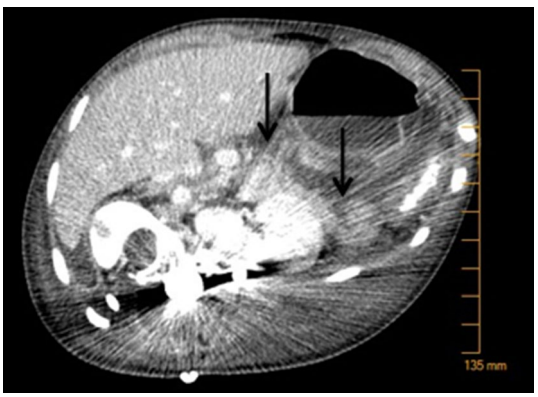

Fig. 3 Abdomino-pelvic CT scan coronal view showing a grade III pancreatic trauma with Wirsung duct disruption

of a pancreatic compression against the spinal block, associated with an induced hypo-perfusion is the most plausible [8]. Clinical picture may include mild specific abdominal pain associated with an increased blood lipase and amylase up to three times the normal levels. Abdomino-pelvic CT scan usually confirms the diagnosis, although it is not systematically ordered [9, 10].

Unlike induced pancreatitis, we report here the case of a pancreatic fracture discovered early postoperative of posterior spinal fusion for thoracolumbar scoliosis with a major Cobb angle of 120° in an adolescent with neonatal cerebral palsy.

Pancreatic trauma is rare, accounting for less than 1% of all abdominal traumas [11]. The deep position of this organ can explain the injury mechanism, with lesions occurring as it is crushed against the fulcrum of the spine during an often indirect trauma. Clinical diagnosis is difficult and often delayed, in an exclusive indirect or direct traumatic context [12, 13].

This diagnosis is confirmed by abdomino-pelvic CT scan, leading to a staging of severity described by Moore et al. [14]. Abnormal pancreatic function tests may frequently be absent in an early stage. This confirmation may also be delayed and subtle due to underestimated lesions according to the imaging specificity and sensitivity (around 80%) [15].

Thus, in the current case, after an initial diagnosis wandering, linked to the nonspecific picture, repeated imaging demonstrated the pancreatic fracture, with a peri-pancreatic and abdominal effusion strongly evocative of a pancreatic fistula, which finally confirms the rare diagnosis of a pancreatic fracture with pancreatic ductal disruption [16] (Fig. 3).

Hypotheses concerning the underlying mechanism have been difficult to confirm, most likely, a massive pancreatic distension occurred during the reduction of the major thoracolumbar deformity. However, the possibility of a direct iatrogenic injury related to the pedicle screws cannot be ruled out. Indeed, a hematoma of the small intestine wall

was diagnosed on the initial radiological workup. Moreover, abdominal exploration confirmed proud pedicle screws, although far away from the injured area.

Nevertheless, the modified anatomical reports could explain this late hypothesis. Another similar case has recently been reported by Al-Binali et al. [17] with delayed diagnosis of small intestine lesion due to spinal instrumentation (Fig. 4).

Rationale for treatment and evidence-based literature

Pancreatic fractures are severe, with morbidity and mortality rates estimated at 26.5 and 5.3%, respectively. Isolated pancreatic fracture prognosis is directly related to the presence of pancreatic duct disruption. The reported complications are the development of pancreatic pseudocysts, chronic pancreatitis, and rarely diabetes in serious pancreas decay [18].

High severity stages (Moore III–V), high elevation of pancreatic enzymes 15 days later are the most common predisposing factors in pseudocyst occurrence.

Therapeutic management of isolated pancreatic fractures should be exclusively conservative in low-stage lesions (I and II) [19]. The management of high grade fractures (III IV) has long been debated; latest published data tend to underline the value of conservative treatment, even if a pancreatic duct rupture is associated. Reports in favor of early emergency surgery management with ductal rupture argue that this attitude considerably reduces the occurrence of recurrences [20–22] which has been estimated to be around 40%.

Given the high morbidity rate of pancreatic resection (about 60%), the conservative attitude remains preferable in case of isolated pancreatic fracture in hemodynamically stable patients.

When secondary pseudocyst occurs, it seems also advisable to favor a conservative management, which is effective in half of the cases. Expansive pseudocyst, symptomatic or compressive ones, may be managed with either endoscopic or image-guided drainage [23].

Procedure section

A surgical abdominal exploration confirmed the suspected diagnosis. The jejunal lesion was resected with direct anastomosis. The duodeno-pancreatic region was out of reach due to the local inflammation. Drains were placed in the retrogastric region. During the exploration, the extremities of some lumbar pedicle screws were observed, a few millimeters proud in the lumbar region in the retroperitoneal area but 10 cm away from the pancreatic area. The postoperative course confirmed the pancreatic lesion involving the Wirsung duct as proved by the important leakage with increased lipase level (initially around 500 ml/day). A conservative management was decided with nil per os and initial antibiotics due to the jejunal perforation.

In spite of the pancreatic duct rupture, we favored the conservative approach for our patient, given the morbidity and mortality rates of proximal pancreatic surgery in a patient with respiratory and nutritional deficiencies. Furthermore, delayed diagnosis of pancreatic duct rupture also influenced the therapeutic management.

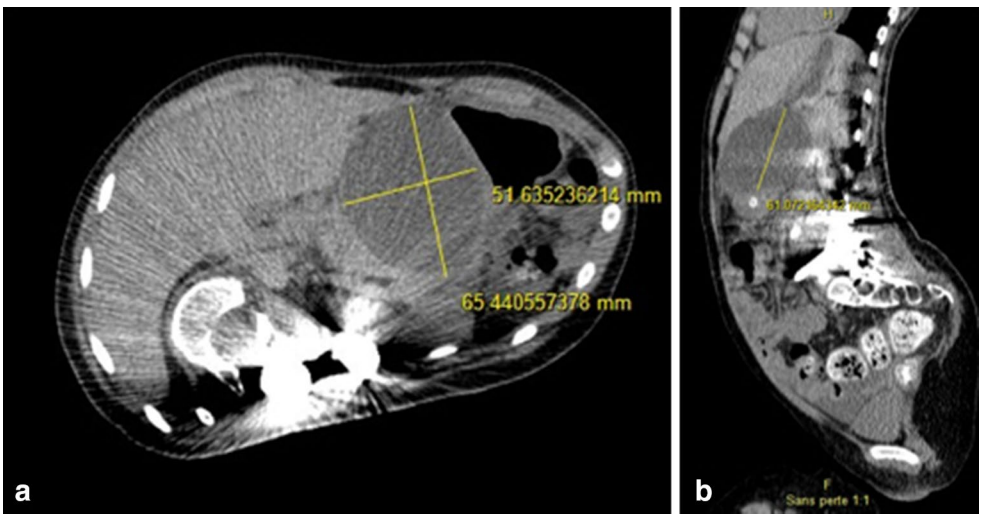

Fig. 4 Abdomino-pelvic CT scan, coronal (**a**) and axial (**b**), showing an expanding pancreatic pseudocyst (about 6 cm in diameter)

Outcome and follow-up

During the further weeks, the amount of fluid dropped progressively to disappear whereas a pseudocyst grew from 2 to 6 cm in diameter (Fig. 4). Despite this evolution, it was decided to manage it conservatively because of the absence of induced symptoms. From an orthopedic point of view, the scoliosis correction was satisfactory with a 50% correction and a good spinal balance. Several weeks later, abdominal symptoms reappeared along with the pseudocyst growth and another biological pancreatitis. Endoscopic drainage (gastrocystostomy) allowed improving clinical and biological parameters. After 6 months of follow-up, the patient remained pain-free and lipase level has eventually dropped to normal. Lately an acute digestive peritonitis without evident cause led to the patient death.

Conclusion

Pancreatic fracture in children and adolescents is rare and the diagnosis complex, as its presentation is often nonspecific. To our knowledge, its occurrence in a postoperative context of scoliosis surgery has never been described. If iatrogenic acute pancreatitis is a relatively common entity, pancreatic fracture should also be considered. Conservative management generally allows complete healing after a few weeks. Secondary pancreatic pseudocyst, which is the most frequent complication, can require an endoscopic or image-guided drainage if symptomatic.

Compliance with ethical standards

Conflict of interest The authors declare no Grant or conflict of interest.

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