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Arachnoiditis ossificans, isthmic spondylolisthesis and pseudomeningocele. A rare clinical scenario

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Summary

The combination of arachnoiditis ossificans, isthmic spondylolisthesis and calcific pseudomeningocele is an extremely unusual condition. In the current literature, there is no previous report of this intricate clinical scenario, and therefore there are no clear indications on the best treatment. In the reported surgical case, the excision of calcific pseudomeningocele, L4 bilateral laminectomy and foraminotomy and posterolateral fusion were performed. L4L5 interbody fusion was aborted for impossibility of neural elements mobilization and a consequent intraoperative dural tear. The aims of the adopted surgical procedure are the decompression of neural elements and the stability due to bone fusion.

Key words: arachnoiditis ossificans, pseudomeningocele, leptomeninges calcifications, clinical symptoms, treatment

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Conflict of interest
The Authors declare no conflict of interest

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Introduction

Arachnoiditis ossificans (AO) is a pathologic ossification of the arachnoid due to chronic inflammation of arachnoid cell clusters, always associated with neurological symptoms and chronic backache [1]. Small calcifications of leptomeninges could represent an asymptomatic incidental finding secondary to age-related degenerative processes. The international literature has reported approximately 70 cases of significant leptomeningeal calcification associated with clinical symptoms. Currently, there is no consensus regarding the aetiopathology, natural history and treatment options of AO [1].

Isthmic spondylolisthesis is characterised by a fracture or a non-union of pars intra-articularis. The most common location is level L5-S1 (95%), although a smaller percentage involves L4-L5 or other lumbar levels (5%) [2].

Pseudomeningocele is an extradural collection of cerebrospinal fluid (CSF), usually resulting from a tear of both dural and arachnoid membrane. Traditionally, pseudomeningoceles have been classified according to the aetiopatology: congenital, iatrogenic and post-traumatic [3,4]. Congenital pseudomeningoceles are rare entities and scarcely investigated in the literature [4]. The association of arachnoiditis ossificans, calcific pseudomeningocele and isthmic spondylolisthesis seems extremely rare and no previous report can be found in the current literature.

Materials and methods

A 54-year old woman came to our attention complaining of bilateral anterior thigh pain and low back pain since 7 months. Physical examination revealed: bilateral L4 radiculopathy (Visual Analog Scale [VAS] leg: 9) with bilateral quadriceps mild motor deficit (M4), left tibialis anterior motor deficit (M3) and bilateral anterior thigh dysaesthesia, in addition to and chronic backache (VAS back: 7). The patient referred no relevant medical pathologies or previous spinal traumas or surgeries.

Standing radiographs demonstrated a L4 isthmic spondylolisthesis grade 2 of Meyerding (Fig. 1). Magnetic resonance imaging (MRI) showed a pseudomeningocele on the right side of the spinous process of L4 (Fig. 2). Computerised tomography (CT) highlighted a diffuse calcification of the leptomeninges, starting at L4 and continuing distally in the sacral part of the spine canal (Fig. 3). The entire arachnoid was involved circumferentially (Fig. 4), raising the suspect of a pathological process involving the leptomeninges (AO, type II) rather than an incidental finding of ossifications of the spinal cord [1]. A meticulous evaluation was performed to exclude endocrine or rheumatoid diseases.

The best procedure was collegially discussed among the senior members of the surgical team: a posterior approach was preferred because of the necessity of large decompression of neural elements due to the AO.

This approach permits direct visualisation and mobilisation of neural elements, massive decompression (achieved through laminectomy and foraminal decompression) and intersomatic arthrodesis with posterior (PLIF) or transforaminal lumbar interbody fusion (TLIF). Anterior approaches for interbody fusion could avoid direct mobilisation of neural elements, but at the same time could add the risk of meningeal lesions due to indirect traction of calcific leptomeninges with the impossibility of prompt management.

For this patient, L4 laminectomy and L4L5 foraminal decompression were performed bilaterally. Afterwards, neural elements were mobilised in order to proceed with the TLIF: unfortunately, this manoeuver caused a dural tear and consequent CSF leakage. After tear repair, due to the impossibility of correct neural mobilisation, the intersomatic procedure was aborted. A posterolateral fusion and bilateral L4L5 transpedicular fixation was then performed.

Discussion and conclusions

The combination of arachnoiditis ossificans, pseudomeningocele and isthmic spondylolistesis is an extremely rare condition and therefore there are no clear indications on the best treatment. To our knowledge, this is the first case reported in literature.

The presence of calcified arachnoid tissue could represent an asymptomatic incidental finding or a pathologic ossification known as arachnoiditis ossificans (AO). The aetiopathology can be idiopathic or secondary to subdural hematoma, intradural bone fragment in spine traumas, infections, spinal surgeries or procedures, hyperparathyroidism, or heterotopic osseous

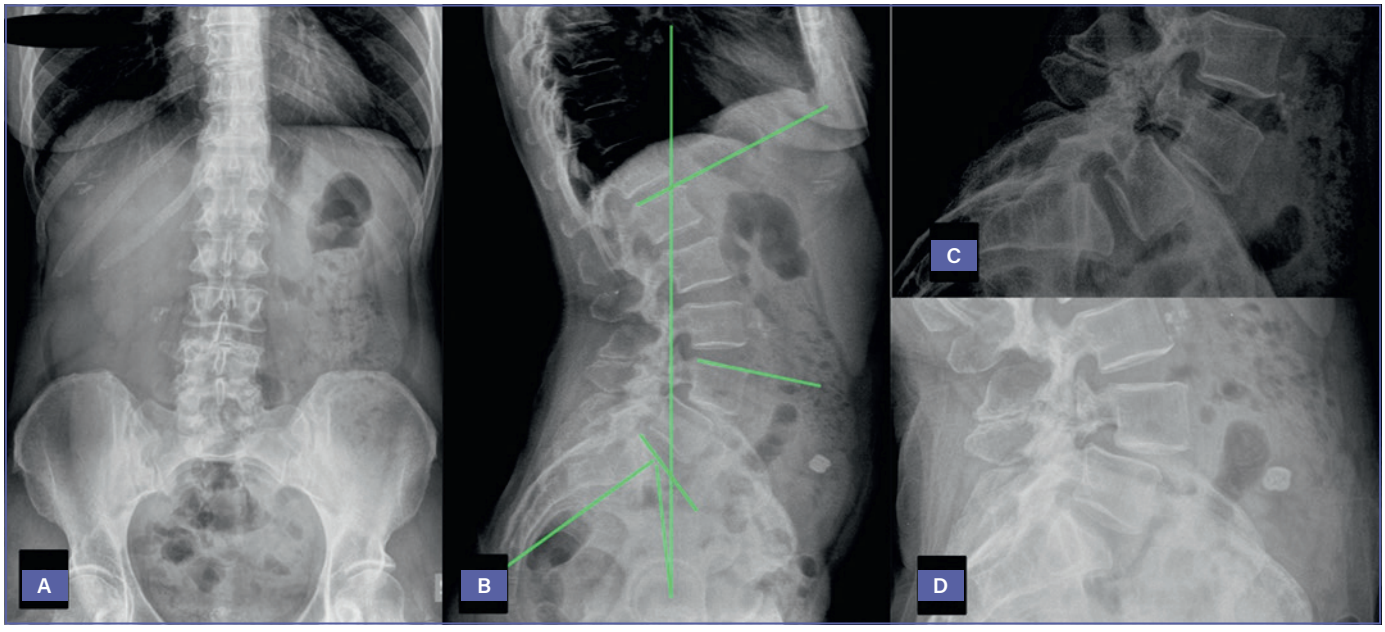

Figure 1. (A,B) antero-posterior and lateral lumbar standing radiographs and (C, D) dynamic flexion and extension lumbar standing radiographs showing L4 isthmic spondylolisthesis.

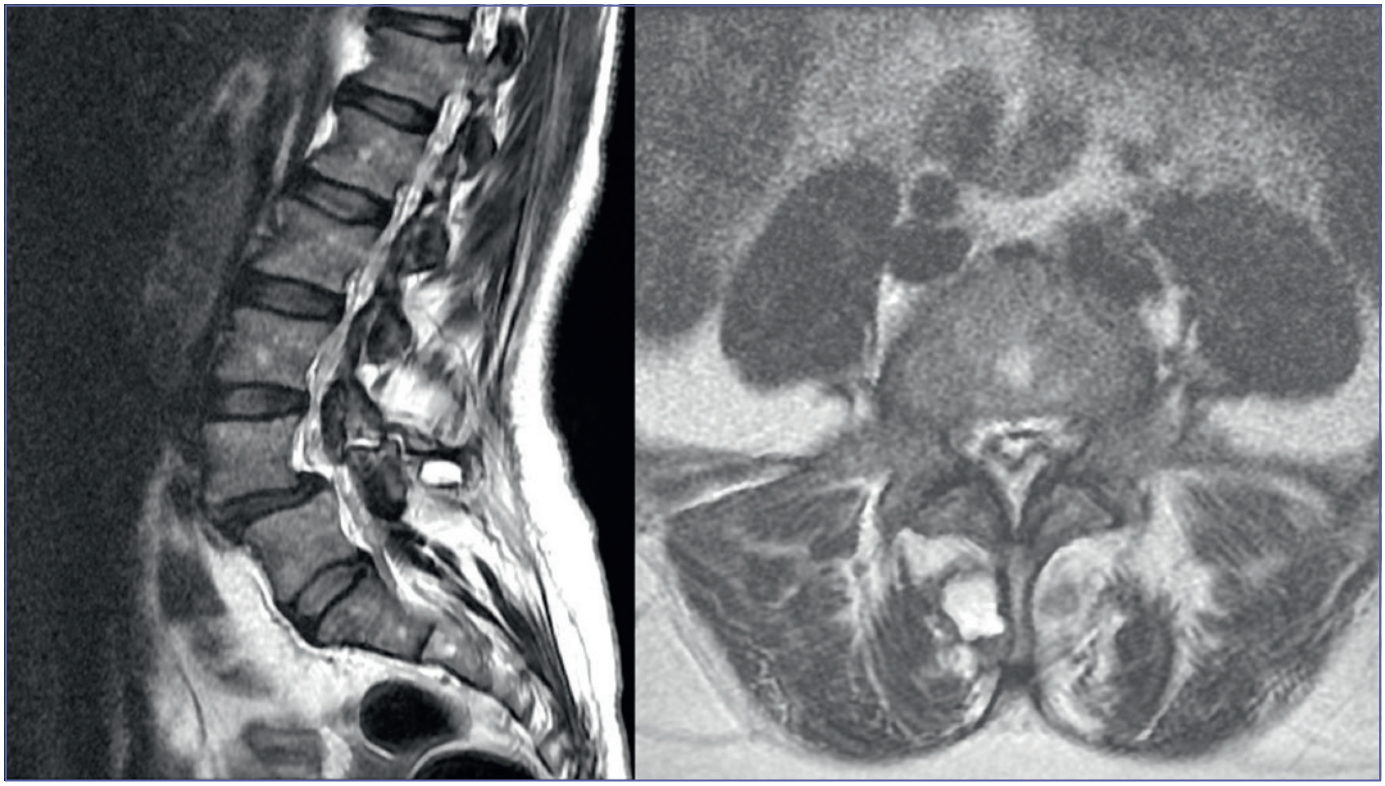

Figure 2. Sagittal and axial T2 weight MRI showing L4 isthmic spondylolisthesis and pseudomeningocele at the right side of spinous process.

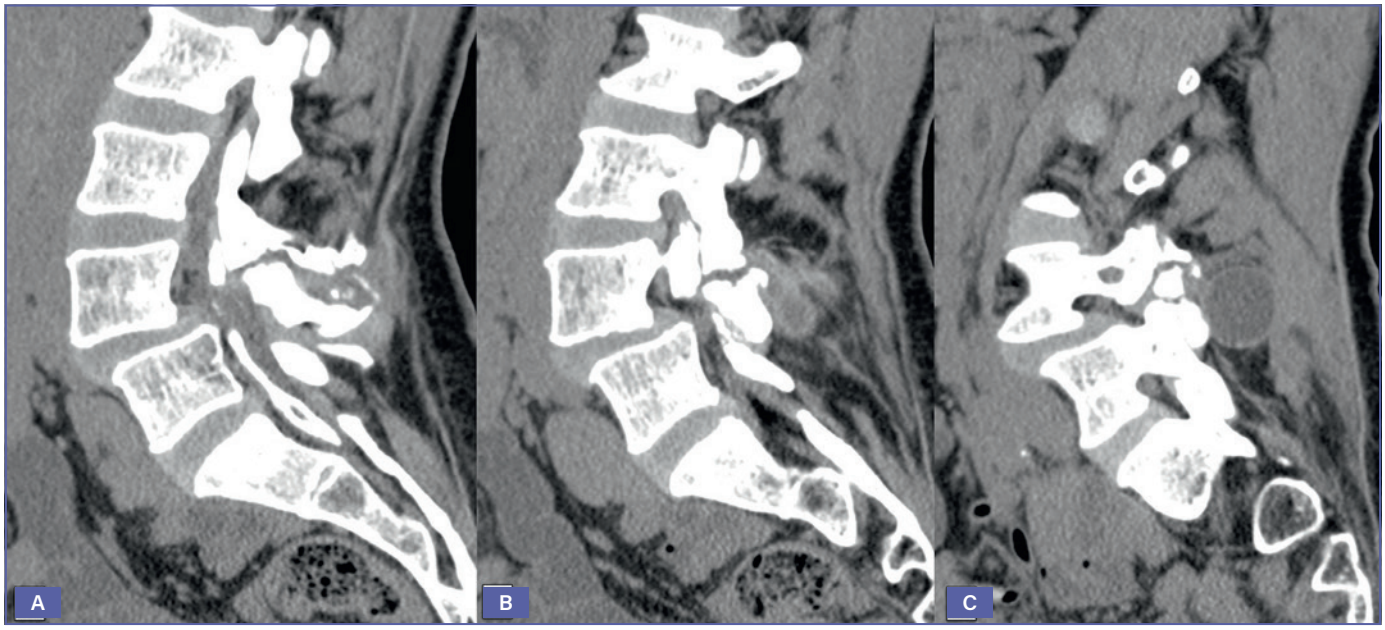

Figure 3 (A,B,C). Sagittal CT-scan from medial to right lateral showing arachnoiditis ossificans and pseudomeningocele.

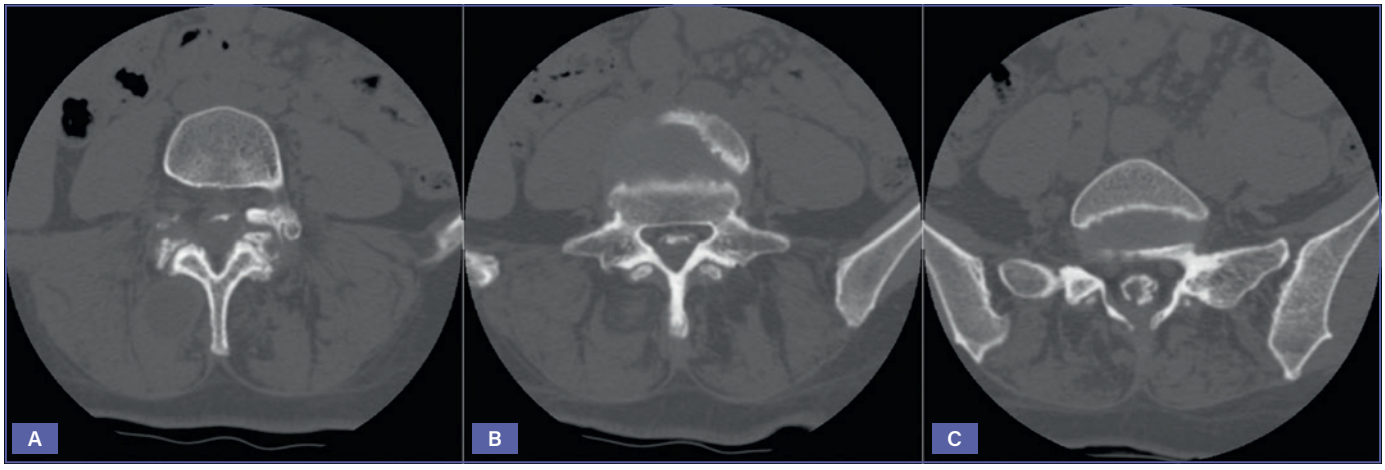

Figure 4 (A,B,C). Axial CT-scan between L5 and S1 showing arachnoiditis ossificans.

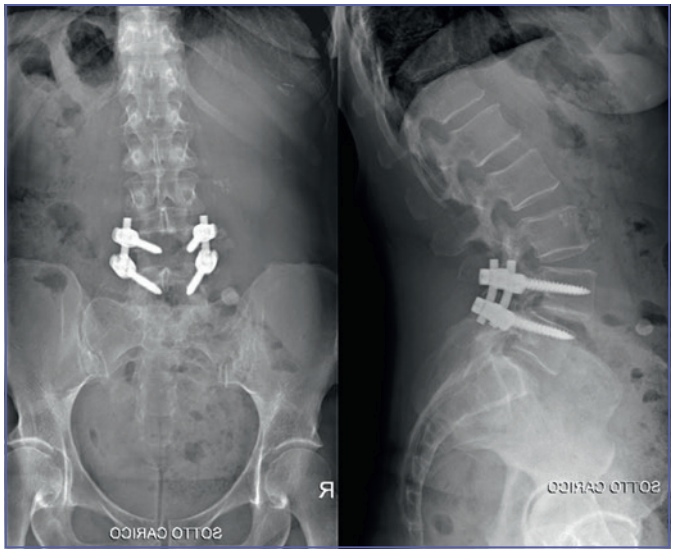

Figure 5. Antero-posterior and lateral lumbar standing post-operative radiographs.

metaplasia. AO is a rare entity that usually affects the thoracic spine (90% of cases), and less frequently the lumbar and cervical regions [1]. Long-standing backache and chronic neurological symptoms, usually radicular pain, are the most common clinical manifestations. AO can be classified according to the involvement of leptomeninges in three categories: type I has a semicircular ("banana-like") appearance. Type II presents as a circular ossification of the arachnoid membrane, as shown in the patient we report, while type III has a honeycomb pattern and the thecal sac is traversed by the calcifications. These calcifications present a histological pattern of trabecular and lamellar bone, resulting indistinguishable from the normal one [1]. There is no consensus on the appropriate treatment strategy, although several authors suggest laminectomy and bilateral facetectomy as reliable surgical solutions [1].

Pseudomeningoceles are classified according to the aetiopathology in post-traumatic, iatrogenic and congenital forms. The most common cause of pseudomeningocele is iatrogenic, resulting from an unintended dural tear during a surgical procedure, most commonly after lumbar laminectomy. Other iatrogenic causes include dural puncture for epidural catheter placement [3]. Post-traumatic pseudomeningoceles are believed to be related to blunt or inadvertent trauma. Spontaneous pseudomeningoceles are extremely rare, although their association with spondylolisthesis has been described [4]. Calcifications are usually an incidental finding in pseudomeningocele. The formation of a calcified wall around the CSF leakage is most commonly the result of a previous hemorrhage [4]. The clinical challenge was to determine which of the mentioned conditions caused the patient's symptoms.

Postoperatively the patient referred resolution of radicular symptoms, with a reduction of L4 radiculopathy (VAS leg: 5), left tibialis anterior deficit (M4) and backache (VAS back: 4). At one month follow-up, no radicular pain (VAS leg: 0), residual motor deficit (quadriceps M5, left tibialis anterior M5), or backache (VAS: 0) was reported: the patient referred the persistence of slight dysaesthesia on the anterior right thigh.

The spondylolisthesis reduction combined with neural decompression achieved resolution of symptoms. The absence of anterior support can be considered as a potential source of surgical failure. However, a salvage interbody fusion procedure can be performed in the future with anterior retroperitoneal lumbar interbody fusion (ALIF) or a lateral trans-psoas approach (LLIF) avoiding scar tissue secondary to previous surgery, reducing both surgical time and perioperative blood loss [5]. Nevertheless, anterior surgeries imply careful management of vascular structures and in case of LLIF of lumbar plexus in the contest of psoas muscle [6].

In conclusion, considering the rarity of this clinical triad and the lack of a clear surgical strategy in current literature, the goals of our surgery are achieving decompression of neural elements and stability due to bone fusion.

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