

Adolescents with symptomatic laminolysis: report of two cases

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Abstract Retroisthmic cleft refers to a cleft in the lamina and is rarely reported. It was first described by Brocher, and later Wick et al. proposed the term “laminolysis” to describe the retroisthmic cleft by analogy with the nomenclature of the applied stress fracture of the pars interarticularis (spondylolysis) and the pedicle (pediculolysis). In this paper, we describe two adolescent sports players with symptomatic lumbar laminolysis. Both improved significantly after adequate conservative treatment. Knowledge of laminolysis in adolescent patients with low back pain is necessary to avoid overlooking it and late diagnosis. For correct diagnosis, multidetector three-dimensional computed tomography (CT) is suggested. In addition, magnetic resonance imaging (MRI) also allows detection of inflammation in the defects.

Keywords Spondylolysis · Retroisthmic cleft · Lumbar spine · Laminar fracture · Stress fracture · Laminolysis

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Introduction

Lumbar spondylolysis (spondylolysis) is a stress fracture of the pars interarticularis in the lumbar spine, which frequently occurs in adolescent sports players [10, 16]. In the adult general population its incidence is around 6% [2, 12]. Although the orientation of pars defects varies widely [7, 9], in most cases they lie closer to the coronal plane in the pars interarticularis [4]. In sports players, stress fractures can occur at the lamina and pedicle as well as at the pars interarticularis [9].

The term “retroisthmic cleft” refers to a cleft in the lamina and is rarely reported. It was first described by Brocher [1], and later Wick et al. proposed the term “laminolysis” to describe the retroisthmic cleft by analogy with the nomenclature of the applied stress fracture of the pars interarticularis (spondylolysis) and the pedicle (pediculolysis) [15]. Wick et al. described an adult case with laminolysis that they followed over a long period of time. However, usually spondylolysis is thought to occur in the adolescent period [2, 12]. We encountered two adolescent sports players with symptomatic laminolysis. Informed consent was obtained from the patients for publication and accompanying images.

Case reports

Case 1

A 15-year-old boy presented with severe low back pain (LBP) that was exacerbated by extension motion of the lumbar spine. He had first felt LBP about 2 years earlier while playing tennis. He had been a swimmer by 12 years old, athlete at 13 years old, and a tennis player from 14 to

15 years old. He was training to become a sumo wrestler at the time of first presentation. Physical examination was notable for tenderness at the L5 spinous process and increased pain with lumbar extension movement. There were no associated radicular symptoms.

Findings on anteroposterior (AP) view and lateral view plain radiographs suggested spondylolysis (Fig. 1). However oblique view films did not reveal any clear defect at the pars interarticularis. Computed tomography (CT) showed a clear defect in the L5 lamina, which looked like double laminae, suggesting laminolysis or pseudoarthrosis in the lamina (Fig. 2). Magnetic resonance images (MRI) showed signal changes on the defect of the L5 lamina, namely low intensity on T1-weighted images and high intensity on fat-saturated T2-weighted images (Fig. 3).

MRI findings indicated inflammatory synovitis in the pseudoarthrosis. Xylocaine and steroid were injected in the zone in relation with the defect. Immediately after the injection, his LBP was completely relieved. He was allowed to resume all his activities. At approximately 2 years of follow-up, he was very active as a professional sumo wrestler.

Case 2

A 16-year-old boy presented with 3-year history of LBP, which was exacerbated by extension motion of the lumbar spine. He first felt the LBP while playing soccer at the age of 13 years, but he had never consulted any doctor. As his

LBP did not subside, his mother took him to our clinic. Physical examination was notable for tenderness at the L4 spinous process and increased pain upon lumbar extension motion. There were no associated radicular symptoms.

AP view and lateral view plain radiographs showed that he presented sacralization of L5 and the most caudal lumbar vertebra was L4 (Fig. 4). The AP view X-ray revealed a horizontal fracture line in the L4 lamina. Findings on lateral view X-ray suggested spondylolysis. However, the oblique views did not show the pars defects, only the defect of the lamina. CT scans showed an apparent defect in the L4 lamina, which was thought to be laminolysis (Fig. 5). MRI showed signal changes on the defect in the L4 lamina, namely signals of high intensity on fat-saturated T2-weighted images and signals of slight and low intensity on T1-weighted images (Fig. 6).

MRI findings also disclosed inflammatory synovitis in the pseudoarthrosis as in case 1. As his LBP at first presentation was not so severe, he was treated by immobilization with a soft trunk brace. He was allowed to resume all his activities. At 1 year of follow-up, he was very active as a soccer player.

Discussion

Spondylolysis is a defect of the pars interarticularis with incidence in the general population of around 6% [2, 12].



Fig. 1 AP view showing a horizontal fracture line in the L5 lamina. From the other plain X-rays, it is difficult to detect the defect

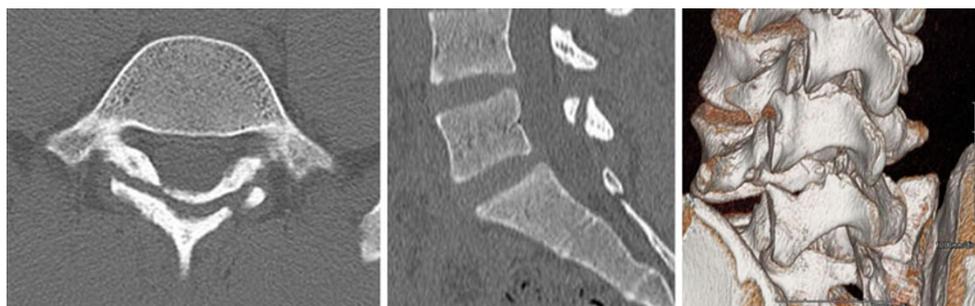


Fig. 2 CT scans showing a clear defect in the L5 lamina

Fig. 3 MRI showed signal changes on the defect in the L5 lamina, namely a low-intensity signal on T1-weighted images and high intensity on the fat-saturated T2-weighted images

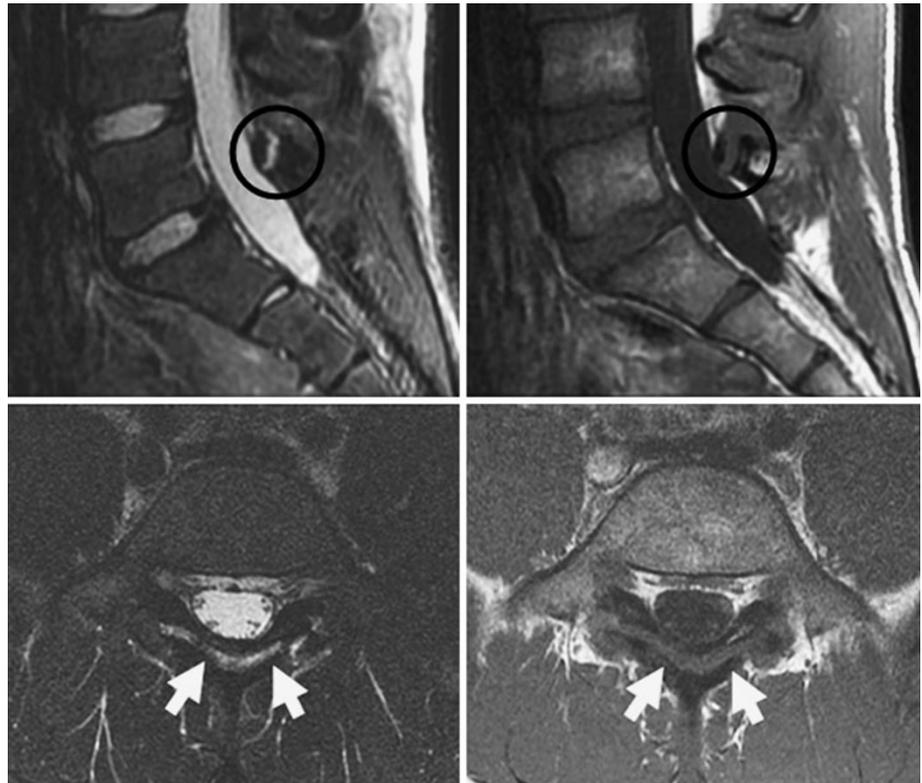


Fig. 4 AP view and lateral view plain radiographs showing that the patient presented sacralization of L5 and that the most caudal vertebra was L4. The AP view indicated a *horizontal fracture line* in the L4

lamina. The lateral view findings suggested spondylolysis. However, the oblique views did not show the pars defects, only the defect of the lamina

Apart from spondylolysis, defects at various portions of the lamina have been reported: spina bifida [8, 12], pediculolysis [10, 11], and laminolysis. Of these, laminolysis is very rarely reported.

The term “laminolysis” was proposed by Wick et al. to describe the classical retroisthmic cleft [15]. Additionally, they suggested that laminolysis was a nonunion after a stress fracture. If laminolysis were a stress fracture of the lamina, the fracture line would have an extreme coronal

orientation. Sairyo et al. [9] analyzed the lines of highest stress at the pars interarticularis using a 3-dimensional (3D) finite-element model (FEM) of a lumbar motion segment (L3 to S1) during various modes, and compared the clinical data of fracture angles on CT scans of patients with spondylolysis. Their results showed that the location/direction of high stresses indicated that extension loading may cause spondylolysis in the coronal orientation, and rotation loading may cause spondylolysis in the sagittal

Fig. 5 CT scans showing an apparent defect in the L4 lamina

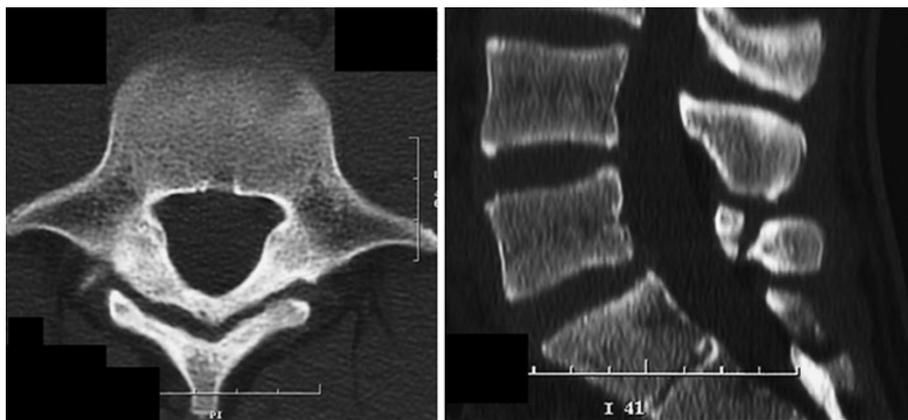
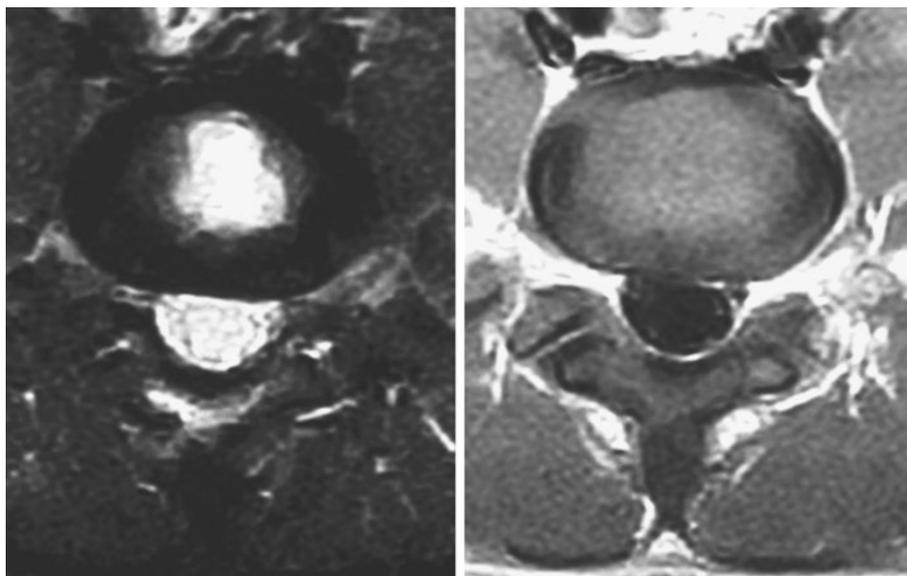


Fig. 6 MRI showing signal changes on the defect in the L4 lamina, namely a high-intensity signal on the fat-saturated T2-weighted images and low-intensity signal on T1 images



orientation. Therefore, laminolysis may be a result of stress fracture due to repetitive extension loading. Furthermore, our patients were adolescent sports player, which supports this theory. According to these points, conservative treatment for laminolysis should be performed as for spondylolysis. Basically, relative rest, abstention from sports, and use of trunk brace are recommended to obtain pain relief and reduce the risk of worsening symptoms. Regarding duration of immobilization with a soft trunk brace, we recommend to wear it until symptom relief. In our opinion, trunk brace should be used for all patients with symptomatic laminolysis. However, as case 1 was a sumo wrestler, he was not able to use a trunk brace.

Although in both cases the defects looked like pseudoarthrosis of the lamina, they were symptomatic and MRIs indicated inflammation at the defects. Usually, pseudoarthrosis of the pars interarticularis is reported to establish communication between adjacent ipsilateral facet joints, and to open communication to the contralateral joint and

through the retrodural space [5]. Furthermore, Shipley et al. [13] histologically examined pars defects that communicated with the facet joint and found focal areas of synovial lining consistent with the diagnosis of synovial pseudoarthrosis, and they suggested that stress fractures of the pars may fail to heal because of the presence of synovial fluid from a nearby facet joint. Actually, the persistent LBP of case 1 was relieved immediately after injection of xylocaine and steroid in the zone in relation with the defect. We suggest that, in the present cases, laminolysis was the same kind of morbidity as pseudoarthrosis of the pars interarticularis. Both cases in this study were allowed to resume all their activities after treatment, and case 1 is active as a professional sumo wrestler at present. However, careful follow-up is required to avoid symptom recurrence.

Laminolysis was thought to be associated with unilateral, contralateral spondylolysis [6], and a hypoplastic, ipsilateral pedicle [17]. Some authors have suggested that,

in the presence of unilateral spondylolysis, the remainder of the neural arch is exposed to abnormal stresses [3, 6, 14, 17]. However, the present cases had no unilateral spondylolysis. To the best of our knowledge, there have been no reports of cases such as the present cases. The pathomechanism of this morbidity was unclear.

Correct diagnosis of laminolysis based only on plain radiographs including oblique views is difficult. As shown here, the findings of plain radiographs were subtle and therefore might have been overlooked. For correct diagnosis, multidetector three-dimensional CT is required. The best visualization of the defect is achieved by reconstructed sagittal views. In addition, MRI also allows detection of inflammation in the defects. In the present study, both cases were symptomatic, and in both of them MRI findings showed low-intensity signal on the T1-weighted image and high intensity on T2-weighted images, which could indicate inflammation. However, there is a limitation regarding the interpretation of MRI findings, because we have no data from asymptomatic cases of laminolysis.

Conflict of interest None.

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