

# Fresh stress fractures of lumbar pedicles in an adolescent male ballet dancer: Case report and literature review

Rui Amari · Toshinori Sakai · Shinsuke Katoh ·  
Koichi Sairyō · Kosaku Higashino ·  
Keizo Tachibana · Natsuo Yasui

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**Abstract** Stress fracture in the pars interarticularis is a common cause of low back pain in young athletes. Pedicle stress fractures have also been reported in adolescent sport players, and most of them were associated with contralateral spondylolysis. Only a few cases with bilateral pedicle stress fractures have been reported. We report a 14-year-old ballet dancer with fresh bilateral pedicle fractures treated conservatively, together with a review of the literature.

**Keywords** Stress fracture · Pedicle · Ballet dancer · Lumbar spine

## Introduction

Stress fracture in the pars interarticularis is a common cause of low back pain (LBP) in young athletes. Micheli and Woods [1] reported that 47% of adolescent patients with LBP who visited a sports clinic had lumbar spondylolysis. Pedicle stress fractures have also been reported in adolescent sport players, and most of them were associated with contralateral spondylolysis (Table 1) [2, 3]. Only a few cases with bilateral pedicle stress fractures have been reported so far [4–8]. We report a case of fresh bilateral pedicle fractures in an adolescent male ballet dancer, together with a review of the literature.

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R. Amari · T. Sakai (✉) · S. Katoh · K. Sairyō ·  
K. Higashino · N. Yasui  
Department of Orthopedics, Institute of Health Biosciences,  
The University of Tokushima Graduate School,  
3-18-15 Kuramoto-cho, Tokushima 770-8503, Japan  
e-mail: norinori@clin.med.tokushima-u.ac.jp

K. Tachibana  
Tachibana Orthopedic Hospital, Tokushima, Japan

## Case report

A 14-year-old boy, who had practiced classic ballet for many years and had won prizes in national ballet competitions, was referred to our department with a history of activity related low back pain (LBP). He had felt this LBP a few weeks earlier while at training camp preparing for the next competition without having experienced any apparent traumatic episode.

At the time of presentation, he complained of LBP without leg pain on extending his back, which was neurologically intact. The plain radiographs showed that his lumbar spine was immature and was classified as in the apophyseal stage. The anteroposterior view plain radiograph showed no pedicle asymmetry or other abnormalities (Fig. 1). Discontinuity of the pedicles or pars interarticularis was not evident on the lateral (Fig. 2) or oblique views (Fig. 3). Computed tomography (CT) revealed fractures in both pedicles of the L4 vertebra (Fig. 4). Sagittal reconstruction CT showed a fracture line that started in the caudal cortex of the pedicle but did not reach the cranial cortex (Fig. 5). There was no marginal sclerosis, and MR images revealed signal changes in bilateral pedicles at L4 (Fig. 6).

The patient was asked to discontinue any sport activities, and wear a corset. The symptom started to disappear gradually, and we confirmed bony union in both pedicles by CT 3 months after the onset of the symptom (Fig. 7). He has resumed classic ballet and had not felt LBP before he stopped dancing 2 years later.

## Discussion

There have been several reports describing pedicle stress fracture in adolescent sports players (Table 1). However,

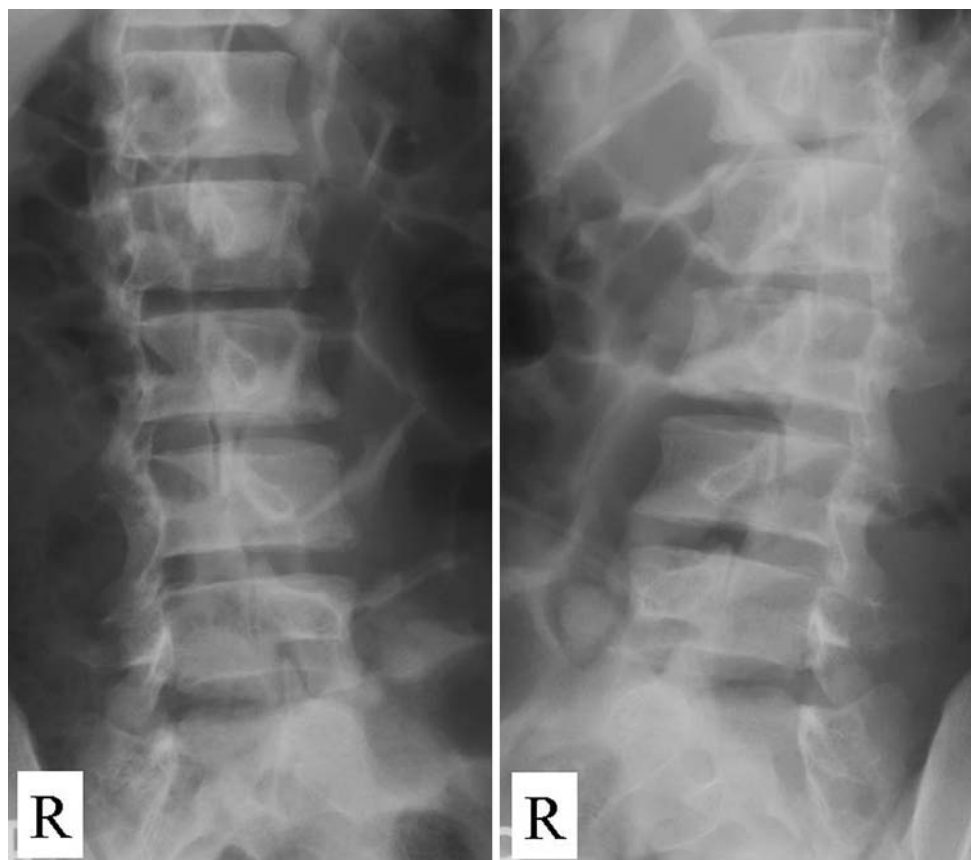
**Table 1** Review of articles on pedicle stress fracture reported in the English literature

Report	Year	Age	Sex	Sports (Occupation)	Level	Treatment	Contralateral Spondylolysis
Abel et al. [1]	1985	17	F	Ballet	L4	?	+
Ireland and Micheli [6]	1987	18	F	Ballet	L2	Conservative	–
Sadiq et al. [8]	2006	36	F	Sedentary office worker	L2	Conservative	–
Parvataneni et al. [7]	2004	19	F	Lacrosse	L5	Fusion	–
Garber and Wright	1984	26	M	?	L4	Fixation	+
Sairyo R et al. [3]	2003	17	M	Baseball		Conservative	+
Gunzburg R et al. []	1989	26	W	?	L5	Conservative Surgery	+
		22	M	Construction	L4		+
Traughber and Havlina [9]	1991	16	W	?	L5	Conservative	–
Sirvanci M et al.	2002	17	M	?	L4	Conservative	+

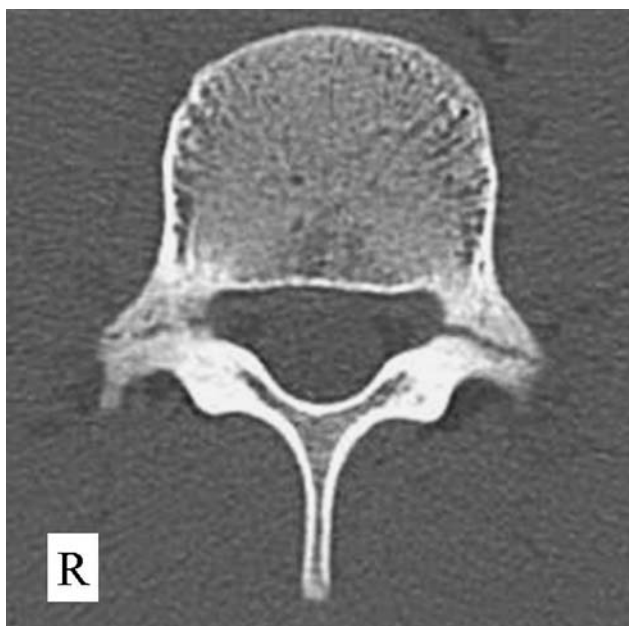
**Fig. 1** Anteroposterior view plain radiograph showing no pedicle asymmetry or other abnormalities**Fig. 2** There was no discontinuity of the caudal cortex of the pedicle on the lateral view

in those previous cases fracture was usually associated with contralateral spondylolysis, and isolated pedicle fractures was rarely found. Parvataneni et al. [7] reported a rare case with bilateral pedicle fractures treated by spinal fusion and a review of the literature. In their review, there were only two reports of bilateral pedicle fractures

in the radiology literature [4, 9]. In this paper, we report a case with isolated bilateral pedicle stress fractures. Fortunately, we did diagnose them in the very early phase which enabled us heal the fractures without surgery. In this phase, a clear fracture line or pedicle asymmetry was not observed on plain radiographs, but the signal changes



**Fig. 3** Pars defect was not noted on the oblique views



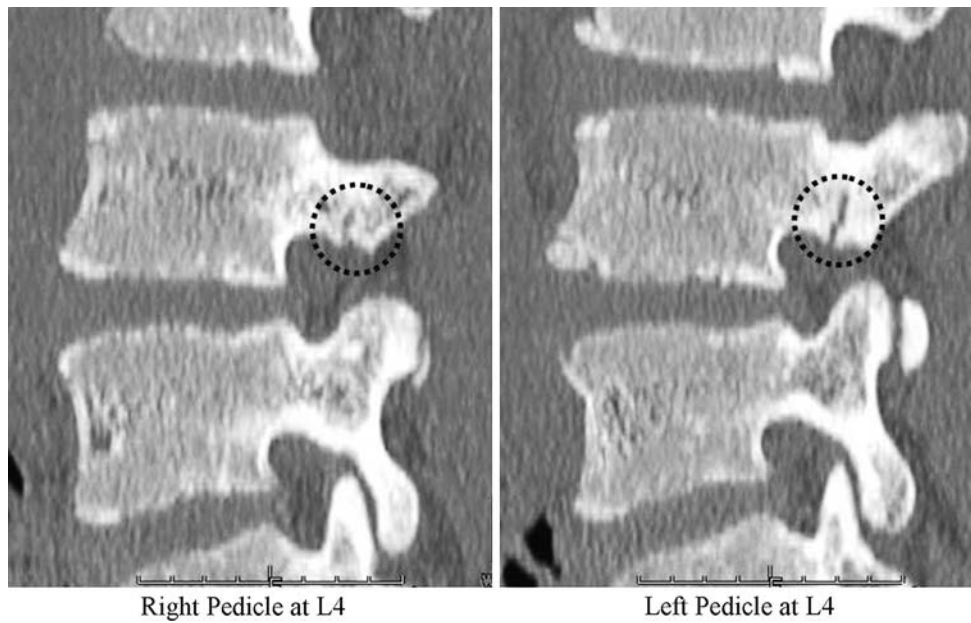
**Fig. 4** CT scan of the L4 vertebra showing fractures in both pedicles

in the pedicles were detected on MRI. The signal changes led us to examine him using CT, and the fractures were clearly visualized. We have previously reported that MRI

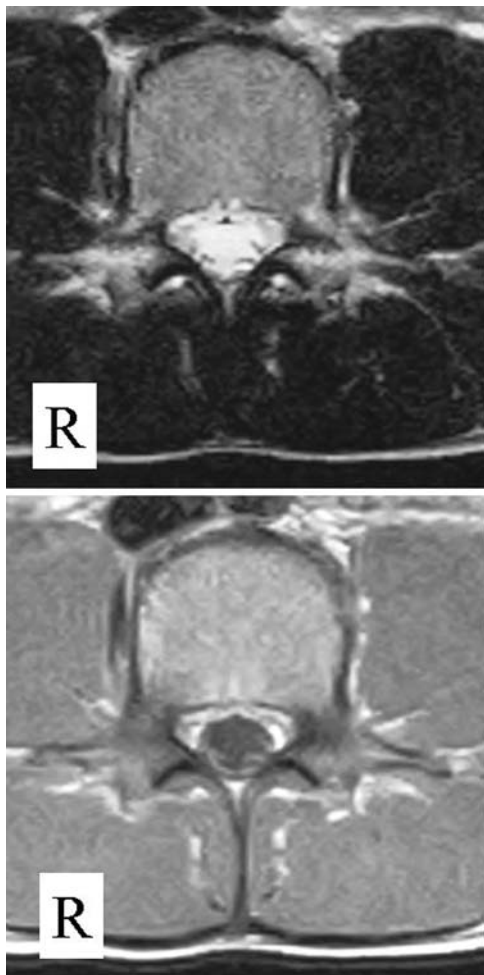
is a useful tool to detect spondylolysis and to predict its treatment outcome, and the present case suggested that MRI is also useful to detect pedicle stress fracture in the early phase.

As the pedicle has greater intrinsic strength and a shorter moment arm from the vertebral body and it can resist greater cyclic shear force [10], thus, stress fracture of the pedicle are much less common than those of the pars. In mechanical testing of the neural arch, the pedicle has been shown to be the second point of weakness after the pars [11]. An in vitro study by Cyron and Hutton [12] reported pedicle stress fracture occurred in 5 lumbar vertebrae in a series of 74 vertebrae.

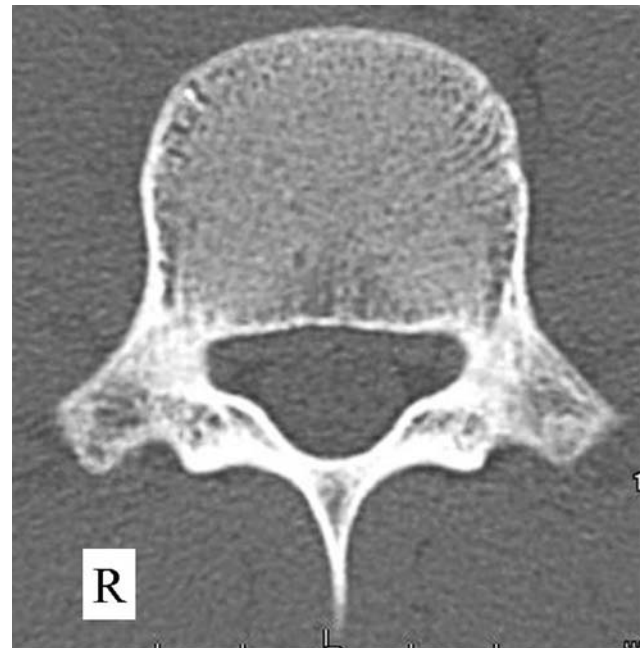
The present case corresponded to a ballet dancer, and there have been two other reports of ballet dancers [4]. Our patient was a 14-year-old boy, and the previous published cases were above 17 years of age. These three patients were thought to have all posterior elements of the lumbar spine intact. Dancing classic ballet needs simultaneous and extreme spinal motion in extension and rotation. Although in the immature spine the weakest portion of the lamina is the pars interarticularis, in the mature spine it may be the pedicle. We assume that there are specific lumbar movements that cause pedicle stress fracture depending on the



**Fig. 5** Sagittal reconstruction CT scan showing a fracture line that started in the caudal cortex of the pedicle but did not reach the cranial cortex



**Fig. 6** MRI showing signal changes in bilateral pedicles at L4



**Fig. 7** CT scan taken 3 months after the onset of LBP showing bony union in both pedicles

age of the person. LBP in a ballet dancer is an indication for a careful investigation of the pedicle for stress fracture.

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