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Case Report

Transsacral transvertebral screw fixation and posterolateral fusion for spondyloptosis in an adolescent

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ABSTRACT

Spondyloptosis is a condition in which the L5 vertebral body dislocates completely from the sacrum anteriorly and descends into the pelvis. Surgical options include posterior and anterior fusion, single- or two-stage operation, and neural decompression. We performed a one-stage operation on an adolescent with spondyloptosis by using an L2–S1 ilium posterior fusion with pedicle screws, cement augmentation, transsacral transvertebral screw fixation (L5–S1), and sacropelvic fixation for an adolescent with spondyloptosis. The clinical result was satisfactory and demonstrated that transsacral transvertebral screw fixation provides a safe and reliable *in situ* fixation of spondyloptosis.

1. Introduction

Spondyloptosis (Grade V spondylolisthesis) is a type of severe spinal deformity that develops during childhood and progresses into adulthood because of the complete dislocation of the L5 vertebral body on the sacrum anterior. The clinical presentations include back pain and radicular pain, which are both aggravated by increased activity, motor and sensory deficits in lower extremities, and occasionally symptoms resembling intermittent claudication or a cauda equina syndrome.[1] The goal of treatment is to relieve pain, restore neurological deficits, and prevent further progression of the deformity. The recommended surgical treatment is typically combined anterior and posterior fusion with reduction using instrumentation.[2–6] However, the transabdominal procedure is technically difficult and may cause severe complications for neural and vascular structures.[4,5]

Previous studies have demonstrated that irreducible spondyloptosis is safely treated with *in situ* fusion, or interbody fusion with fibular autologous bone grafts or cages.[10,19,21] However, this approach is dependent on technique, more expensive, and susceptible to donor-site morbidity.

We describe the case of a patient in whom L5 on S1 spondyloptosis and dysplasia of the sacral dome were treated with a single-stage posterior approach by using L2–S1 ilium posterior fusion with pedicle screws, cement augmentation, transsacral transvertebral screw fixation (S1 to L5), sacropelvic fixation, and bilateral posterolateral fusion.

2. Case report

On November 11, 2009, we examined a 13-year-old girl who had been experiencing urinary and stool incontinence for 2 years. She underwent a laminectomy of L5 at another medical center 4 months prior to the first consultation, but her symptoms had not improved. Symptoms of intermittent claudication, collapsing, lower back pain radiating to the bilateral lower limbs, and poor exercise tolerance led the patient to seek further medical assistance. Our institute conducted a series of examinations that included plain films (Fig. 1A and B), computed tomography (Fig. 2), and magnetic resonance imaging, and we admitted the patient. The postlaminectomy radiographic test revealed spondyloptosis L5 on S1, and dysplasia of the sacral dome. The neurological examination showed Grade 4 paresis of the lower extremities, in addition to decreased deep tendon reflexes for both legs. Paresthesia of the L5–

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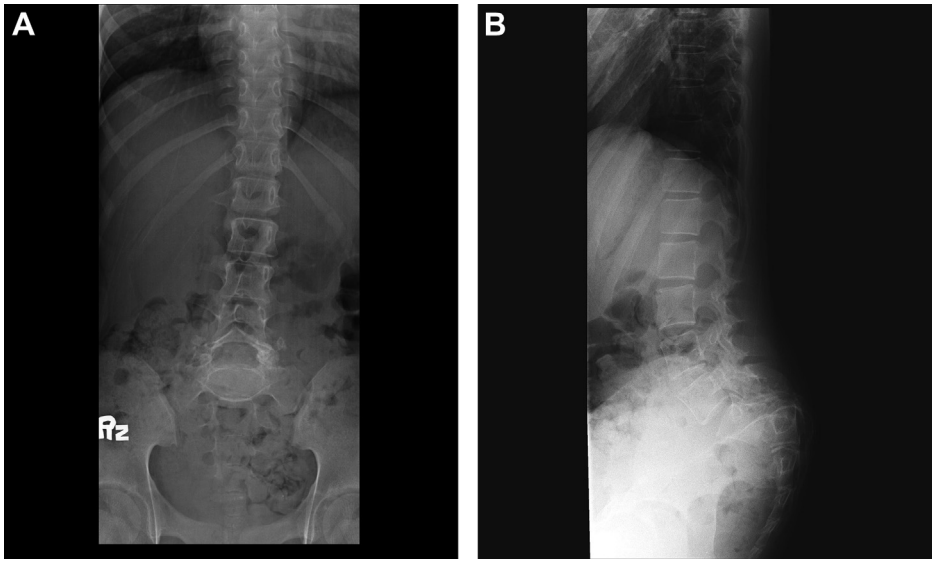

Fig. 1. Spondyloptosis of L5 on S1 was seen preoperatively on plain film: (A) anteroposterior view and (B) lateral view.

S1 dermatome was also noted. The anal tone was lost, but the perineal sensation was intact. We performed a single-stage posterior-approach surgery on the Day 3 after admission (Fig. 3). During the operation, L2–S1 ilium posterior fusion with pedicle screws, cement augmentation, transsacral transvertebral screw fixation (S1 to L5) with two ilium screws in each side (sacropelvic fixation), and bilateral posterolateral fusion were applied.

The surgery was conducted with the patient in a prone position on the operating table. A standard posterior midline lumbosacral approach was used to expose the spine from L2 to S1. We

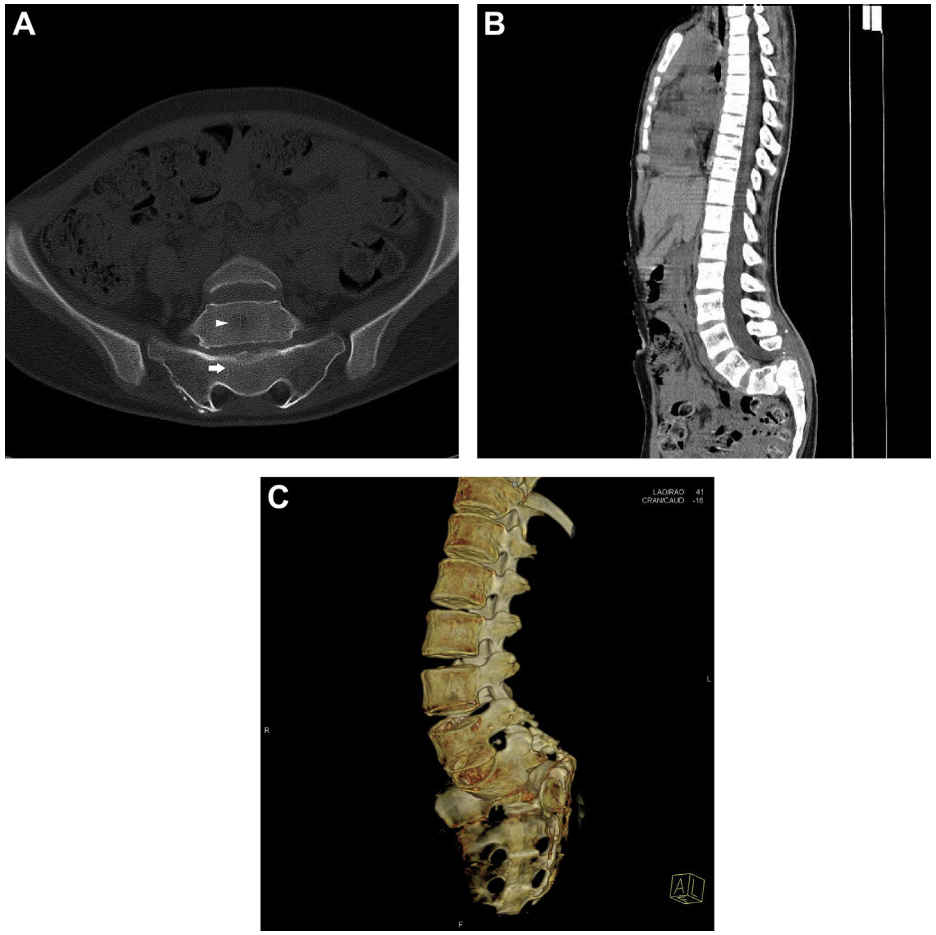

Fig. 2. Computed tomography (CT) scan revealed L5 on S1 anteriorly on (A) coronal view (arrow indicates S1 and arrowhead indicates L5), (B) sagittal view, and (C) image reconstruction in CT.

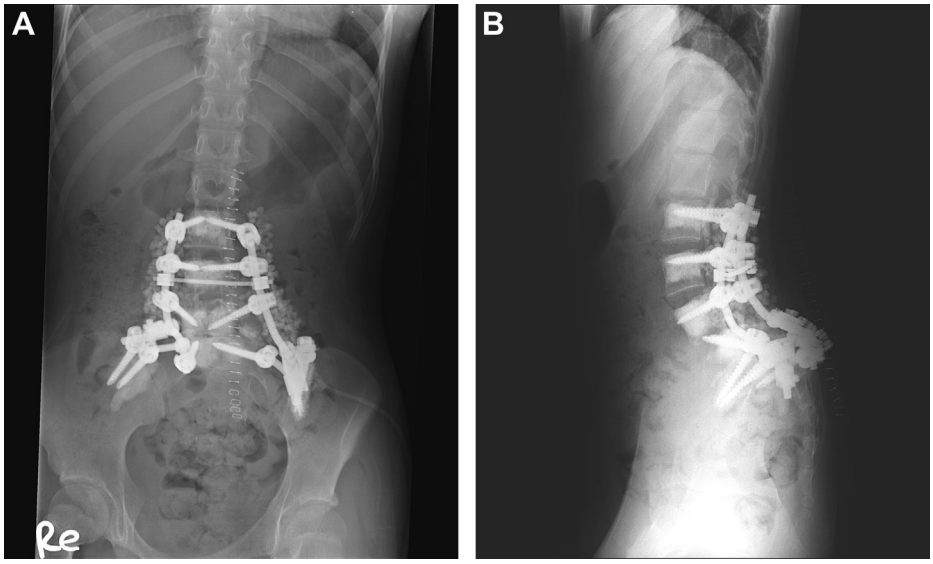

Fig. 3. Postoperative plain film revealed L3–S1 ilium posterior fusion with pedicle screws, cement augmentation, transsacral transvertebral screw fixation (S1 to L5), and sacropelvic fixation, and bilateral posterolateral fusion: (A) antero posterior view; (B) lateral view.

decompressed the pars interarticularis of L5 by removing the scar tissue that had formed around the area. The L5 nerve roots were completely decompressed bilaterally. Bilateral pedicle screws were inserted at L2, L3, and L4, and two iliac screws were fitted in each side with cement augmentation. The entrance point of the S1 pedicle screws was below and lateral to the inferior tip of the superior articular process of S1 (Fig. 4). A 3.2-mm drill bit was passed toward the center of the S1 vertebral body through the S1 pedicle, traversing the L5–S1 disk space and entering the anterior superior aspect of the L5 vertebral body. Using a probe, we ensured that the drill tunnel passed through the S1 pedicle and the L5 vertebral body in the correct position. The transsacral transvertebral screw was passed into the track, and cement augmentation was used to stabilize the slippage between L5 and S1 (Fig. 5). The procedure was repeated on the other side. Rods were prebent and connected to the screws with appropriately sized slotted connectors. After performing segmental instrumentation, we inserted bone substitute chips for posterolateral fusion between L2 and S1.

After surgery, the patient gradually regained her strength. The Foley catheter was removed on postoperative Day 5, and she was able to void normally. The postoperative wound healed satisfactorily. By the follow-up consultation 4 weeks after surgery, the patient was ambulatory and complained only of slight pain at the surgical site. After 24 months, the patient was coping well and performing physically undemanding work. At this time, the plain films showed stable fixation without loosening or migration (Fig. 6).

3. Discussion

Spondyloptosis is a condition with an unclear etiology in which the L5 vertebral body dislocates completely from the sacrum anterior and descends into the pelvis.[4] The etiology of the disease is unclear, and the treatment of patients with spondyloptosis is a challenge. The goal of treatment is to relieve pain and minimize neurological deficits, to prevent the progression of deformities, and to provide long-term stabilization by using solid fusion.[5,15,22] The clinical indications for the surgical treatment of spondylolisthesis include pain, progressive slippage, neurological abnormality (most commonly caused by radiculopathy), and progressive deformity.[7]

Various methods are used to describe the treatment of *in situ* arthrodesis with or without decompression,[8–11,15] as well as the treatment of spondyloptosis with reduction and fusion (posterolateral and/or anterior, single-, double-, or triple-staged).[4,7,12,14,22] Most researchers agree that *in situ* fusion methods are safe and reliable for the treatment of high-grade spondylolisthesis. Although the reduction methods yield better results than *in situ* arthrodesis where the rates of fusion, relief of pain, correction of deformity, and

Fig. 4. Posterior aspect of the sacrum. Concentric circles indicate the position below and lateral to the inferior tip of the superior articular process of S1, which the entry points locate in each side.

Fig. 5. The transsacral transvertebral screw was passed into the track through the S1 pedicle and the L5 vertebral body to stabilize slippage between L5 and S1 with cement augmentation.

improved appearance are of concern, documented disadvantages included a longer more technically complex procedure, with an increased risk of complications such as an L5 root deficit, and bowel, bladder, or sexual dysfunctions.[4,12,14] Moreover, the deformity may continue to progress after the reduction and fusion methods have been applied.[9,13] We favor a single-stage operation with posterior surgery in our patients. This posterior approach has been used successfully, resulting in fewer complications.[15–18]

Various methods have been described for *in situ* fusion of spondyloptosis. Decompression and anterior and/or posterior fusion may additionally be performed. Bohlman and Cook[10] described a single-stage posterior approach applicable to the completely dislocated lumbosacral joint, which includes posterior neural decompression, bilateral posterolateral fusion, and interbody fusion by using a fibular strut. In this technique, the dura is gently freed from the posterior prominence of the first-sacral vertebral body following a wide fifth lumbar, sacral, and, if necessary, fourth-lumbar laminectomy, as well as a wide fifth-lumbar and first-sacral foraminotomy. Thereafter, the sacral prominence is osteotomized to decompress the dura anterior. Next, posterior interbody fusion is performed with bilateral fibular strut grafts inserted into bilateral holes drilled into the L5 and S1 bodies. The fibula was selected for interbody arthrodesis because of its inherent strength. In 2004, Bozkus and Dickman[19] performed a similar technique by using posterior interbody-cage (transsacral transvertebral cage) insertion and pedicle-screw fixation. They reported a reduction of deformity in the treatment of a patient with high-grade spondylolisthesis.

Graft-related complications (fracture, resoption, or bending) occurred in cases of single-stage decompression and posterolateral and interbody fusion.[20] However, no complications related to screws have been reported in series involving transsacral pedicle screws. Transsacral titanium cage-augmented fixation has been proposed to reduce the incidence of fibular graft-related complications. The cage has three major advantages: its elasticity modulus is higher than that of a fibular graft, its pullout strength is greater than that of pedicle screws, and graft material can be packed inside the cage.

We performed a single-stage operation using an L2–S1 ilium posterior fusion with pedicle screws, cement augmentation, transsacral transvertebral screw fixation (L5–S1), and two ilium screws in each side (sacropelvic fixation). To simplify the procedure, we inserted the transsacral transvertebral screws without harvesting a fibular graft or preparing the tunnel for a fibular graft or an interbody cage. Instead, we used cement augmentation and sacropelvic fixation to strengthen the structure. Following fusion,

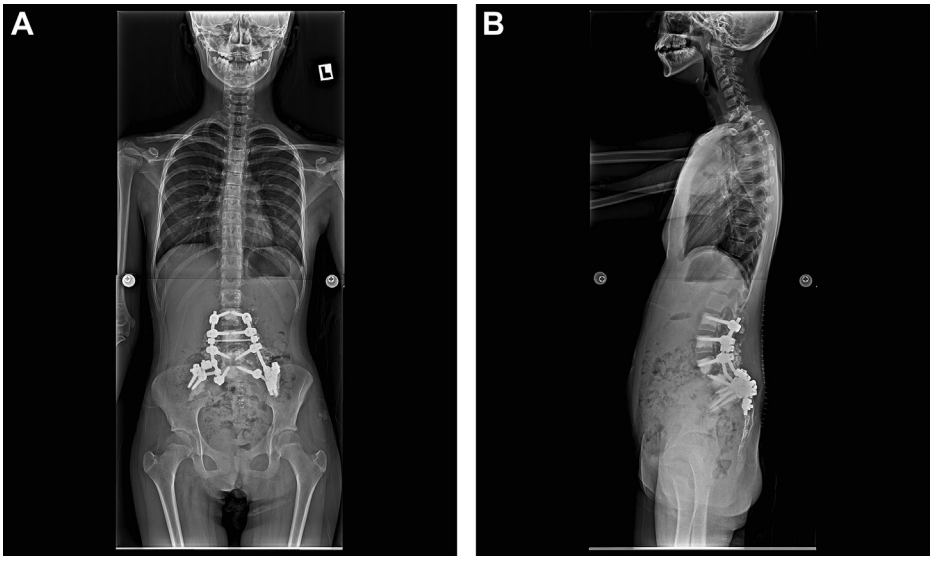

Fig. 6. Scanogram was taken at 24 months after the operation: (A) antero posterior view; (B) lateral view.

and for 24 months after the surgery, the deformity did not progress. Symptoms of low back pain as well as urinary and stool incontinence had been completely resolved. The method performed on the patient presented in this case may be considered technically reliable and safe, providing adequate decompression, solid fusion, and long-term stabilization in L5–S1 spondyloptosis.

In conclusion, the single-stage operation with the transsacral transvertebral screw fixation of L5–S1 spondyloptosis provides a safe and reliable *in situ* fixation, and is less complex than fibular strut grafts, interbody fusion, or an anterior approach.

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