The Development of Vertebral Deformities in a Preschool Child with Dysplastic Spondylolisthesis: A 16-Year Follow-Up

Masayuki Ohashi*, Toru Hirano1, Naoto Endo1 and Seiji Uchiyama2
1Division of Orthopaedic Surgery, Department of Regenerative and Transplant Medicine, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan
2Department of Orthopaedic Surgery, Nishi-Niigata Chuo National Hospital, Niigata, Japan

Abstract

Study design: A case report describing the development of vertebral deformities associated with dysplastic spondylolisthesis that was managed conservatively until skeletal maturity was achieved.

Objective: To describe development of wedging and rounding vertebral deformities.

Summary of Background Data: There are no reports of preschool children with dysplastic spondylolisthesis that were managed conservatively until skeletal maturity.

Methods: A 5-year-old girl presented with a postural deformity associated with congenital scoliosis and dysplastic spondylolisthesis. Surgery was performed for scoliosis at the age of 13 years, but spondylolisthesis was managed conservatively up to skeletal maturity.

Results: The wedging of the L5 body and the rounding of the sacrum progressed during her growth period, and no progression was observed thereafter. The slippage progressed gradually during and after her growth period, and posterior lumbar interbody fusion was performed at the age of 21 years.

Conclusion: We speculate that the slippage associated with dysplastic spondylolisthesis occurs at the growth plate, and vertebral deformities are the results rather than the causative factors of the slippage as observed in the case of slippage associated with ischmic spondylolisthesis.

Keywords: Dysplastic spondylolisthesis; Vertebral deformity; Development of deformity; Wedging deformity; Rounding deformity; Posterior lumbar interbody fusion

Introduction

Dysplastic spondylolisthesis is defined as spondylolisthesis secondary to congenital abnormalities of the lumbosacral articulation, including maloriented or hypoplastic facets and sacral deficiency [1]. Dysplastic spondylolisthesis is characterized by wedging of the L5 body and a rounding deformation of the sacrum surface on radiography [2]; further, it has been suggested that these 2 anatomic factors play an important role in the development of a slip [3-5]. However, some authors have stated that these changes should be considered as the consequences rather than the causes of the olisthetic process in adolescents with spondylolysis [6-10].

The dysplastic type is less common, and symptomatic patients usually require surgical treatment at a relatively early age because the natural history of this condition is progressive [3,11-14]. Therefore, there are no reports of preschool children with dysplastic spondylolisthesis that has been managed conservatively until skeletal maturity was achieved. For this reason, it is controversial whether vertebral deformities such as wedging of the L5 body and rounding deformation of the sacrum surface are the consequences or causes of the olisthetic process in dysplastic spondylolisthesis.

We report the 16-year follow-up of a 5-year-old with dysplastic spondylolisthesis who did not exhibit vertebral deformities at the first radiologic examination.

Case Report

A 5-year-old girl presented with a postural deformity. She was diagnosed at birth with Treacher Collins syndrome, a form of the spectrum of mandibulofacial dysostoses. She was neurologically intact and had no back pain. A radiograph of the thoracic spine revealed a right congenital scoliosis that measured 47° with a unilateral unsegmented bar (Figure 1). In addition to the thoracic deformity, lumbar radiographs revealed lumbosacral spondylolisthesis. The horizontal facets of the lumbosacral junction were observed in the

Figure 1: The anteroposterior radiograph of the thoracic spine at 5 years of age showing right congenital scoliosis with an unsegmented bar.

*Corresponding author: Masayuki Ohashi, Division of Orthopaedic Surgery, Department of Regenerative and Transplant Medicine, Niigata University Graduate School of Medical and Dental Sciences 1-757 Asahimachi Dori Niigata City 951-8510, Japan, Tel: +81-25-227-2272; Fax: +81-25-227-0782; E-mail: masayuki-ohashi@ksh.biglobe.ne.jp

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anteroposterior view (Figure 2A), and the lateral view did not reveal spondylolysis (Figure 2B). Therefore, we diagnosed the condition as dysplastic spondylolisthesis. The percentage of the slip was 40% (Meyerding grade [8] was grade 2), and the lumbar index was 100%. The rounding deformation of the sacrum surface was not indicated (rounding index was 0%). These parameters were measured on a standing lateral roentgenogram according to the method described by Boxall et al. [4] and Wiltse and Winter [15].

The patient required operative treatment for scoliosis at the age of 13 years. Preoperative standing radiographs revealed thoracic scoliosis that measured 123°. Posterior spinal fusion from C7 to T10 with instrumentation was performed, and thoracic scoliosis was corrected to 86°.

Clinical observation with radiographic examinations was chosen for dysplastic spondylolisthesis because the patient was free of symptoms and was at risk for general anesthesia complications due to mandibular hypoplasia, one of the anomalies associated with Treacher Collins syndrome.

Her body height and the development of the slippage and vertebral deformities such as wedging of the L5 body and rounding of the sacrum surface are shown in Figure 3. Her body height was 104 cm at the age of 5 years and increased to 142 cm up to the age of 14 years, after which it remained constant. The percentage of the slip increased up to 14 years and was 65% (Meyerding grade 3). Thereafter, it gradually increased and was 72% (Meyerding grade 3) at 20 years of age. The lumbar index decreased before she reached the age of 14 years; thereafter, radiographs showed a constant lumbar index of approximately 60°. The rounding index increased up to 14 years of age and thereafter remained constant at approximately 50% as determined by radiography (Figures 2B and 4). All these parameters progressed dramatically between the ages of 10 and 14 years, i.e., her growth period.

At the age of 20 years, she presented with progressive lower back pain and bilateral thigh pain, and surgery was performed at the age of 21 years. A computed tomography (CT) scan revealed subluxation of the bilateral L5/S1 facets (Figure 5). The operation was conducted with the patient in the prone position on an operating table. Pedicle screws were placed in the pedicles of L5 and S1. Next, L5 laminectomy was performed, and the inferior articular facets of L5 and the superior articular facets of S1 were removed. The reduction of the anterior slippage of L5 and posterior lumbar interbody fusion with titanium cages were then performed. The percentage of the slip was corrected to 16% (Meyerding grade 1, Figure 6).

The patient had no postoperative motor and sensory deficits, and the treatment resulted in complete pain relief. A CT scan at 3 years after the surgery showed complete fusion without a loss of correction, and the patient has remained asymptomatic.
Discussion

Isthmic spondylolisthesis is reported to be prevalent in the growth period [11,16,17] and very rarely occurs thereafter. In order to explain the prevalence of slippage in children, Farfan et al. [18] speculated that slippage results mainly from an epiphyseal separation. Some clinical and biomechanical studies have provided further evidence that slippage occurs at the growth plate, and wedging of the L5 body and rounding of the sacrum surface, which are well-known deformities associated with isthmic spondylolisthesis, are the results of the slippage rather than the causative factors [6,7,9,19-21].

The dysplastic type is less common and constitutes 14–21% of the cases in a large series [4,22]. The patients with dysplastic spondylolisthesis are notably more likely to exhibit vertebral deformities at the first radiologic examination and require surgical treatment at an early age because the natural history of this condition is much more progressive than that of the spondylolytic type [3,11-14]. Therefore, there have been only 3 published reports on patients who were treated conservatively [4,23,24]. However, in these reports, the age of the patients at the initial examination ranged from 8 years to the mid-teens, and vertebral deformities such as wedging of the L5 vertebral body and rounding of the sacrum surface were already observed in their first radiographs. Therefore, there are no reports of preschool children with dysplastic spondylolisthesis that was treated conservatively up to skeletal maturity and who did not exhibit the abovementioned vertebral deformities at the first examination. Thus, it is controversial whether vertebral deformities are the results or the causative factors of the slippage.

In our case, radiographs showed spondylolisthesis with 40% slip, a lumbar index of 100%, and a rounding index of 0%; further, wedging of the L5 body and rounding deformation of the sacrum were not indicated when our patient was initially examined at the age of 5 years. The slippage developed from 40% to 60% during her growth period, and thereafter increased more gradually. The wedging of the L5 body and the rounding of the sacrum progressed during her growth period and did not progress thereafter. This suggests that the slippage associated with dysplastic spondylolisthesis also occurs at the growth plate, and wedging of the L5 body and rounding of the sacrum surface are the results of the slippage rather than the causative factors as observed in the case of slippage associated with isthmic spondylolisthesis. However, more cases would be required to provide further evidence.

References