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Spondylolysis and isthmic spondylolisthesis of the lower lumbar vertebrae in children and adolescents

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Introduction The problem of spondylolysis and spondylolisthesis in children is caused by many factors, with difficulties in producing a timely clinical diagnosis appearing to be the most significant of these factors. **Materials and methods** Overall, 98 children between the age of 3 and 18 years with the diagnosis of spondylolysis and spondylolisthesis of the lower lumbar vertebrae were examined. The patients' complaints, medical histories, and the results of clinical and radiation diagnosis were evaluated. **Results** It was determined that the pathology occurred with greater frequency in boys (65.3 %). Diagnosis occurred with the same frequency in children aged 10–15 years and 15–18 years (39.79 % and 41.85 %), respectively. **Conclusion** Spondylolysis and spondylolisthesis need further study to reduce the problem severity not only in the pediatric population but in adult patients as well.
Keywords: children, spondylolysis, isthmic spondylolisthesis, diagnosis

INTRODUCTION

Various types of spondylolysis and isthmic spondylolisthesis of the lower lumbar vertebrae affect patients of different ages [1, 2]. The majority of researchers believe that these disorders originate in childhood and adolescence, in contrast to other degenerative and traumatic types of spondylolisthesis [3, 4]. Awareness of pediatricians regarding the clinical symptoms of spondylolysis and isthmic spondylolisthesis of the lower lumbar vertebrae enables them to direct the patients to with pediatric traumatologists-orthopedists; they, in turn, conduct clinical and radiological examination to confirm the diagnosis and accordingly prescribe treatment and rehabilitation measures in a timely manner, often in the early stages of the disease [5].

MATERIALS AND METHODS

We enrolled 98 children and adolescents (64 males, 65.3 %) aged 3–18 years with spondylolysis and isthmic spondylolisthesis of the lumbar vertebrae treated in our institution in 5 years. The patients were stratified as per age as follows: <10 years, 18 (18.36 %) children; 10–15 years, 39 (39.79 %); and 15–18 years, 41 (41.85 %). To determine clinical diagnosis, symptoms, medical history, and clinical and imaging results were analyzed. Radiological evaluation included conducting plain radiographies of the lumbar spine and sacrum (98 patients), computed tomography (91 patients), and magnetic resonance imaging (11 patients). The patients' neurologists were consulted in 65 cases.

To determine the severity of spondylolisthesis, the Meyerding classification was used [6]; in addition, 2 cases of spondyloptosis were diagnosed based on the recommendations of Junge [7]. To determine the nature of the spine abnormalities, the Ulrich classification was used [8].

RESULTS

The main symptom of all 98 patients was low back pain. The severity pain differed according to the criteria of the visual analog scale [9]. Using this scale, 15 adolescents reported an average value of 2 points: in 7 of them, the pain syndrome corresponded to 1 point; in 3, 2 points; and in 3, 3 points. In 2 patients, the algia syndrome severity was 4 points. Stratified by age groups, constant pain was reported in the group of 15–18-year-old patients. In the other 2 age groups, a feeling of fatigue and pain localized to the lumbosacral region was inconsistently reported to occur occasionally at the end of the school day or during physical activities associated most often with sports and choreography. Radiation of pain in one of the lower extremities was noted by 18 (18.37 %) patients.

The main clinical findings of physical examination were as follows: pain in the spine during palpation in 98 (100.0 %) patients, multidirectional functional blocking in 98 (100.0 %), asymmetry of paired structures of the

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body in 95 (96.93 %), winged scapula in 90 (91.83 %), muscular defense of lumbar spine in 83 (84.69 %), lumbar hyperlordosis in 74 (75.51 %), restriction of the spine function in 71 (72.44 %), painful axial load in 54 (55.1 %), scoliosis with vertebral torsion in 32 (32.65 %), and flattening of the lumbar lordosis in 24 (24.48 %).

Neurological symptoms included diplegia and lower spastic paraparesis in 3 (3.06 %) patients. The most commonly reported neurological manifestations included positive straight leg raise in 35 (35.71 %) patients, decreased tendon reflexes in 28 (28.57 %), and impaired sensitivity in 19 (19.38 %).

The outcome of diagnostics analysis revealed that in 12 (12.24 %) cases, spondylolysis proceeded in isolation (9 [75.0 %] bilateral and 3 [25.0 %] unilateral) and in 86 (87.76 %) cases, spondylolysis was accompanied by spondylolisthesis of a vertebral body.

In most cases (79; 91.87 %), L5 vertebral body dislocation was present. In 5 (5.81 %) cases, dislocation of transitional vertebra (with S1 lumbalization) was found. In 2 (2.32 %) cases, spondylolisthesis of L4 vertebra was confirmed.

A frequency analysis of each of the known severity levels of spondylolisthesis of lumbar vertebrae revealed that the first severity level of the disease was present in 75 (87.23 %) patients, the second level was present in 7 (8.13 %) patients, and the third and fourth were registered in 1 (1.16 %) patient each. In 2 (2.32 %) cases, spondyloptosis of L5 vertebra was confirmed (**Fig. 1**).

Sixty-three (64.27 %) patients had signs of spine and sacrum dysplasia. In 30 patients, one malformation was revealed; in 19, 2 malformations; and in 14, 3 or more malformations. Malformations included nonclosure of the sacral canal in 15 (23.8 %) patients, lumbalization of vertebra S1 in 11 (17.46 %), and sacralization of L5 vertebra in 4 (6.34 %). The most common of malformation was nonclosure of the back of the arches (spina bifida posterior) L5 in one or more sacral vertebrae.

Spina bifida posterior (apperta and occulta) was detected in 89 vertebrae in 63 patients. In cases of projection of the lower lumbar spine and sacrum, there were such external stigma of disembryogenesis as telangiectasia; and if later, during radiology, the nonclosure of the back of the vertebral arches was detected, these forms were referred to as spina bifida posterior apperta. If radiograms and tomograms of the spine and sacrum showed defects of the posterior parts of the vertebrae but there were no cutaneous manifestations in their projection, these clinical observations were referred to as spina bifida posterior occulta. In 55 (87.3 %) of the 63 patients, the latent form (occulta) was predominant.

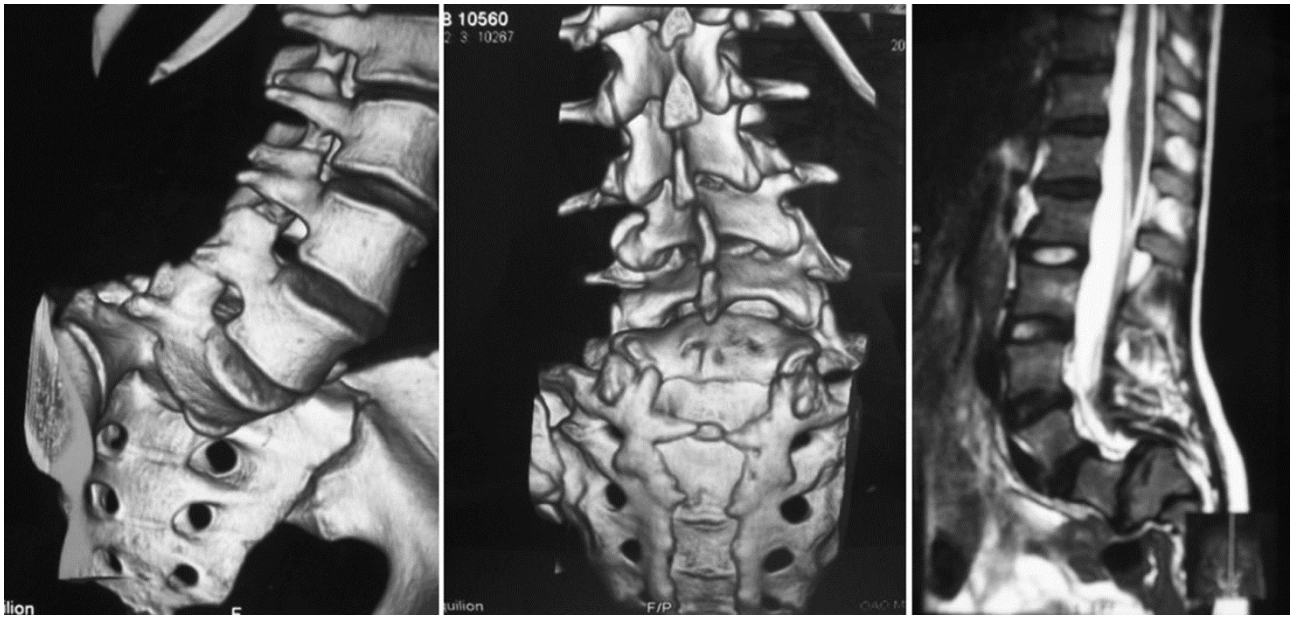

Fig. 1 CT of the lumbar spine and sacrum in patient B, aged 15 years with spondyloptosis of the L5 vertebra and nonclosure of the sacral canal

DISCUSSION

Spondylolysis and spondylolisthesis in lumbar vertebrae in children and adolescents are more common than is presently recognized. The main clinical symptom in children is pain in the lumbar spine. The presence of pain and a history of injury, in conjunction with other clinical symptoms, including vertebrogenic pathology of lumbar localization, should prompt physicians to conduct plain radiography assessments of this region of the spine. Spondylolisthesis is likely to occur following the dislocation of L5 vertebra anterior to the sacrum in the

lateral projection. Computed tomography can help reveal these disease risk factors.

It is not possible to radiologically examine the state of the spine in all children, even in those presenting with back pain; however, it is reasonable to detect children at higher risk of the development of pathology and perform a more thorough and targeted examination. This order of assessment can be applied, for example, in groups of children practicing gymnastics where the probability of overloading the posterior support column of the spine is significant, leading to risk of formation of Looser's zones in the L5 vertebra.

CONCLUSION

Various aspects of spondylolysis and spondylolisthesis in the lumbar vertebrae in children and adolescents remain understudied. In this regard, further studies of clinical manifestations, diagnosis, treatment, and prevention of this disease are necessary to reduce the severity of the problem, not only in the pediatric population but in adult patients as well.

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