

Spondylolysis and Spondylolisthesis of the Lumbar Spine

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Introduction:

Spondylolysis and spondylolisthesis are the most common causes of structural back pain in children and adolescents. Spondylolysis is classified as dysplastic (congenital), isthmic (stress fracture), degenerative, or traumatic. A spondylolysis in a child or adolescent most commonly results from a defect or stress fracture in the pars interarticularis of the vertebra. The pars interarticularis is the part of the vertebra between the superior and inferior facets (**Figure 1**). The defect in the pars interarticularis may allow anterior (forward) displacement or slippage of the vertebra which is called spondylolisthesis (**Figure 2**). Spondylolisthesis or slippage occurs in about 30% of patients with a spondylolysis. The slippage is much more common in individuals with bilateral spondylolysis and those with mechanical instability. The spondylolisthesis is often classified on the degree of the slip with **Grade I: 0-25%, Grade II: 25-50%, Grade III: 50-75%, Grade IV: 75-100%, and Grade V: greater than 100% slippage**. Approximately 85-90% of cases of spondylolysis occur at the L5 vertebral level.

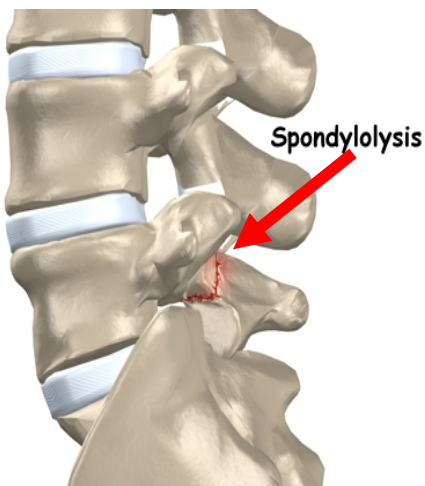


Figure 1: Spondylolysis with L5 pars interarticularis fracture

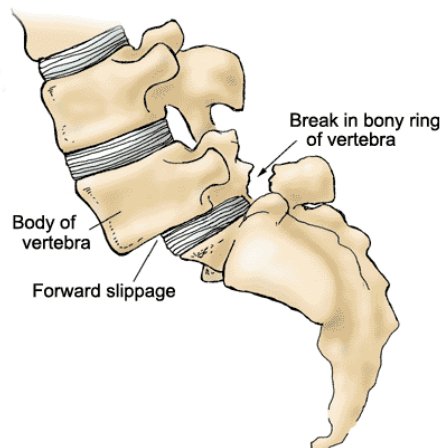


Figure 2: Spondylolysis with L5-S1 spondylolisthesis

Many people with spondylolysis have no symptoms and do not even know that they have the condition. There is an overall incidence of 5-6% in the general population, however only 10-15% of those individuals will develop symptoms.

What Causes Spondylolysis?

The exact cause of spondylolysis is unknown, although certain risk factors have been identified. For example, spondylolysis is much more common in individuals participating in sports that require frequent or persistent hyperextension of the lumbar spine. These sports include gymnastics, diving, wrestling, weight lifting, and football linemen (Figure 3 A-C). It is believed that the repetitive trauma can weaken the pars interarticularis and lead to a spondylolysis.

Another theory is that genetics plays a role in the development of the pars defects and spondylolisthesis. Certain racial groups such as Inuit Eskimos have a much greater overall incidence (approximately 40%) of spondylolysis suggesting inherent genetic weakness of the pars.



Figure 3A-C: Sports requiring frequent hyperextension of the lumbar spine

How are Spondylolysis & Spondylolisthesis Diagnosed?

The diagnosis of spondylolysis is made based on your child's symptoms, physical examination, as well as radiographs (x-rays) of the spine. Standing PA, LAT, and Oblique x-rays of the lumbar spine are often obtained to evaluate for possible spondylolysis or spondylolisthesis (Figure 4A &B). In addition, a SPECT bone scan, Computerized Tomography (CT), and an MRI scan can be used to assess for a possible spondylolysis (Figure 5A &B). The bone scan can also be useful in differentiating an acute stress reaction (spondylolysis) from a chronic defect.

The most common finding on physical examination is low back pain and pain with extension of the lumbar spine (Figure 4). Hamstring tightness is another very common finding in patients with spondylolysis. Most patients will not have neurological symptoms or referred pain to the lower extremity. However, there may be radiating pain with or without neurological symptoms (numbness, weakness, tingling) with higher grades of spondylolisthesis (Grade III, IV, and V).



Figure 4: Extension of lumbar spine

Figure 4A: Bilateral spondylolysis with Grade II-III L5-S1 spondylolisthesis

Figure 4B: Extension of the lumbar spine on physical examination

How are Spondylolysis and Spondylolisthesis Treated?

The treatment for spondylolysis and spondylolisthesis is initially conservative and aims to reduce pain and facilitate healing. Conservative treatments for acute spondylolysis include activity modification (resting from sports participation), bracing (Boston overlap brace/ anti-lordotic brace (Figure 6), and physical therapy to improve flexibility and strength. Non-steroidal anti-inflammatory medications (NSAID) [Motrin, ibuprofen, Naprosyn] can be used to reduce pain and decrease inflammation. In addition, a bone stimulator is occasionally used for an acute spondylolysis to facilitate healing (Figure 7). The treatment of spondylolysis and spondylolisthesis is based on the patients' symptoms. For acute spondylolysis, the anti-lordotic brace and physical therapy are usually initiated for 6-12 weeks. If the patient has no pain following this initial conservative treatment, he/she can discontinue using the brace and gradually resume sports and activities as tolerated. It is often advised that sports requiring extensive or repeated hyperextension be avoided if possible. Non-surgical conservative treatments successfully relieve pain in approximately 80-85% of children and adolescents with acute spondylolysis.

If the patient has persistent symptoms, the above conservative treatments are continued. Steroid/Lidocaine injections might be recommended as part of the treatment plan to reduce pain and inflammation around the pars interarticularis region of the spine.

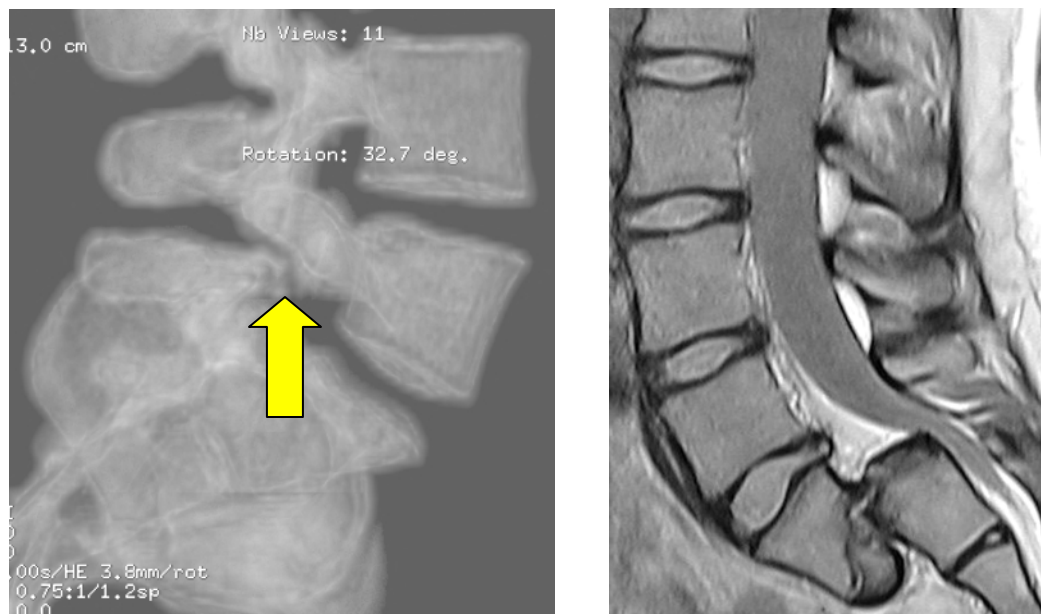


Figure 5A: CT scan with 3D reconstruction of L5 spondylolysis

Figure 5B: MRI scan of Grade IV L5-S1 spondylolisthesis

Surgical treatment might be recommended if there is persistent pain despite extensive conservative therapies. Surgical treatment is also often recommended in children who have a severe spondylolisthesis (Grade III slip and greater). This is done to prevent further slippage of the vertebrae and chronic pain. There are many different surgical procedures for spondylolysis and spondylolisthesis. Direct repair of the spondylolysis and/or posterior spinal arthrodesis (fusion) with bone grafting can be performed in patients with persistent pain and/or severe slips (Figure 8A & B).



Figure 6: Bone stimulator that is occasionally used in the treatment of spondylolysis

Figure 7: Boston Overlap LSO brace (anti-lordotic brace)

Points to Remember:

- Spondylolysis is a common cause of low back pain in adolescent athletes
- Hamstring tightness is commonly associated with spondylolysis
- Treatment is generally conservative and consists of activity modification, rest from sports/activities, use of a Boston Overlap lumbar brace, physical therapy, pain medication, bone stimulator and/or injections to relieve pain
- Spondylolysis and spondylolisthesis are treated symptomatically (no pain=no treatment necessary {except in cases with severe slips which may require surgical correction/ arthrodesis})
- If extensive non-surgical therapies/treatment fails to improve symptoms, there are several surgical options available. The most common surgical procedures used in treating spondylolysis and spondylolisthesis are direct repair of the defect and/or posterior instrumented spinal arthrodesis (fusion).



Figure 8A: Direct repair of L5 spondylolysis

Figure 8B: L4-L5 Posterior instrumented spinal arthrodesis

