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Lumbar Spondylolysis And Spondylolisthesis

Authors

Chester J. Donnally III[1]; Matthew Varacallo[2].

Affilations

[1] University of Miami Hospital
[2] Department of Orthopaedic Surgery, University of Kentucky School of Medicine

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Introduction

Spondylolysis refers to a defect in a posterior defect in the vertebral body at the pars interarticularis. Usually, this defect is due to trauma or from a chronic repetitive loading and hyperextension. If this instability results in translation of the vertebral body, spondylolisthesis has occurred. This process requires a fracture or deformation of the posterior spine elements creating an elongation of the pars. This condition occurs in all ages with the underlying cause varying based on age group. If the slip progresses to the point of neurologic compromise, then surgical intervention may be required to decompress and stabilize the affected segments. In the absence of motor deficits, a nonoperative course of analgesia, activity modification, and injections should be tried for several months.

Etiology

Isthmic spondylolisthesis refers to a defect within the pars interarticularis usually from repetitive microtrauma and accounts for the vast majority of cases in children and adolescents. **Degenerative** spondylolisthesis is the most common form of spondylolisthesis seen in adults. It is due to chronic degenerative changes at the posterior elements resulting in the incompetence of the surrounding ligamentous structures, leading to elongation and slippage. Acutely, a **traumatic** spondylolisthesis can occur following a high-energy injury flexion/extension that causes a fracture-dislocation at the posterior elements. Another type is **dysplastic** spondylolisthesis which is a result of an abnormal formation of the posterior elements resulting in this subsequent instability.

Epidemiology

The rates of spondylosis and spondylolisthesis vary widely by age groups. In the pediatric population, spondylosis is present in about 5% of the population, most commonly (90%) at the L5 to S1 transition. Long-term studies estimate that about 15% of those with a defect (spondylosis) will develop a slip (spondylolisthesis). In regards to adults, lumbar spondylolisthesis without a defect in the pars (and so not isthmic type) is noted in 5% of men, 10% women. It is not always symptomatic. This degenerative type is usually noted at the L4 to L5 levels (versus isthmic noted at L5 to S1). Degenerative spondylolisthesis is an acquired type of spondylolisthesis occurring much more frequently and gradually in the adult population. Cohorts with degenerative spondylolisthesis will rarely develop a high-grade spondylolisthesis. Furthermore, the chronic natural history of this disease process is such that with further degenerative changes, the vertebral segments may eventually stabilize and the patients can have subsequent clinical improvements.

Pathophysiology

Repetitive micro-traumas from hyperextension lead to elongated or absent pars interarticular. This applies additional stress to the facet joint followed by the hypermobility leading to advanced degeneration of the disc space. The reduced disc and facet stability results in translation of the vertebral body, creating a stenotic effect on the exiting

nerve roots and/or the spinal canal. In the traumatic setting, a flexion distraction energy may cause a localized vertebral body failure at this segment, predisposing the patient to chronic issues if instability develops.

History and Physical

Initial evaluation of lower back pain is first directed by obtaining a history from the patient. This history should pertain to the timeline of pain, radiation of pain, and inciting events. Careful attention to prior episodes of trauma should be noted. Low-grade slips and stenotic canals may decompress and relieve pain with leaning forward. It is important to note patient comments such as decreased pain with- pushing a grocery cart or walking upstairs as both common actions have the spinal column in forwarding flexion. It is also important in any evaluation of extremity issues to inspect circulation as vascular claudication may mirror or mimic the neurogenic issues.

Classically patients may complain of pain radiating down both buttocks and lower extremities. An evaluation of the patient walking is also critical to better assess the daily impact this pain or deficits is causing. All physical examinations will include evaluation of the neurologic function of the arms, legs, bladder, and bowels. The keys to a thorough exam are organization and patience. One should evaluate not only strength but also sensation and reflexes. It is also important to inspect the skin along the back and document the presence of tenderness to compression.

Performing a straight leg test to a supine patient may also reveal a stenotic canal. This may also cause local sites of pain as hamstring contractures are often associated with spondylolisthesis. As mentioned above, a thorough neurologic examination is required. Commonly a patient will have an L5 radiculopathy resulting in weakness of ankle dorsiflexion and extension of the great toe. This deficit may also diminish the Achilles tendon reflex. An L4 radiculopathy may present with weakness at the quadriceps and a decreased patellar tendon reflex.

Documentation is paramount as these initial findings will likely be used as a baseline for all future evaluations.

Evaluation

Evaluation of patients with low-back pain typically includes anterior-posterior (AP) and lateral radiographs of the impacted area. Some physicians will obtain radiographs of the entire spine. A key component to radiographic evaluation is obtaining flexion/extension films as this helps illustrate VB stability. Serial standing lateral radiographs obtained in the clinic will help track the progression and healing.

One of the crucial measurements to note in regards to slips is the amount of translation between vertebral bodies. The amount of “uncovering” of one endplate from the other determines the grade. There are four grades of spondylolisthesis: Grade 1: 0% to 25%, Grade 2: 26% to 50%, Grade 3: 51% to 75% and Grade 4: 76% to 99%. At 100% displacement, patients have developed spondyloptosis. Grades 1 and 2 are considered low-grade slips. Grades 3 and 4 are considered high-grade spondylolisthesis.

An MRI is critical when evaluating patients with suspected spondylosis and spondylolisthesis. Frequently these patients will initially trail a six-week course of physical therapy and upon follow-up, if the symptomology is still present an MRI can be obtained at that time. The focus should be directed to the T2 weighted sagittal, and axial images as these will illustrate any compression of neurologic elements.

Treatment / Management

Non-surgical intervention includes- modification of the activity that may have exacerbated the pain, non-steroidal anti-inflammatory medications (NSAIDs), physical therapy, stretching, and at times the use of a lumbosacral orthosis. A 2009 meta-analysis evaluating spondylolysis and grade 1 spondylolisthesis showed almost 84% of adolescent patients treated nonoperatively had a successful clinical outcome at one year. This study also showed no difference in those who did and did not use a brace. Likely it is the activity restriction and not bracing which determines the overall outcome. Additionally, a course of at least six weeks of physical therapy with an emphasis on core exercise strengthening and stretching should be attempted.

While most patients improve with nonoperative treatment alone, those failing a conservative treatment course have three options- continued pain, complete avoidance of activities that elicit pain, or surgical intervention. Again, the surgical options for spondylolysis (as well as low-grade spondylolisthesis) should be reserved for those with either neurologic deficits, the progression of a slip, and pain limiting daily functions. The literature regarding the optimal surgical procedure, approach, and roles for decompression and instrumentation remain controversial. While there is still controversy regarding the need for posterior decompression for patients who have just radicular symptoms, what should be agreed upon is the need for decompression when a true motor deficit is present. It is important for the patient to understand that while surgical intervention has favorable outcomes for relieving radicular pains, the results are less predictable for non-radiating lower back pain.

Pearls and Other Issues

Many patients will improve with a nonoperative treatment course directed at activity modification. Patients should understand that surgery frequently will not relieve all of the pain as irreversible damage to the nerves may have already occurred. The future of minimally invasive treatment options will continue to perfect outcomes for spinal stenosis. Advancements in pain control and endoscopic technologies now allow for select patients and facilities to perform endoscopic disc debridement followed by percutaneous instrumentation on an out-patient basis. Additional research will be directed towards optimizing treatment outcomes and predicting which patients will develop symptomatic progression of a slip.

Questions

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References

1. Fredrickson BE, Baker D, McHolick WJ, Yuan HA, Lubicky JP. The natural history of spondylolysis and spondylolisthesis. J Bone Joint Surg Am. 1984 Jun;66(5):699-707. [PubMed: 6373773]
2. Klein G, Mehlman CT, McCarty M. Nonoperative treatment of spondylolysis and grade I spondylolisthesis in children and young adults: a meta-analysis of observational studies. J Pediatr Orthop. 2009 Mar;29(2):146-56. [PubMed: 19352240]
3. Mostofi K, Gharaie Moghaddam B, Karimi Khouzan R, Daryabin M. The reliability of LERI's sign in L4 and L3 radiculalgia. J Clin Neurosci. 2018 Apr;50:102-104. [PubMed: 29993363]
4. Solomou A, Kraniotis P, Rigopoulou A, Petsas T. Frequent Benign, Nontraumatic, Noninflammatory Causes of Low Back Pain in Adolescents: MRI Findings. Radiol Res Pract. 2018;2018:7638505. [PMC free article: PMC5822929] [PubMed: 29593901]
5. Abi-Hanna D, Kerferd J, Phan K, Rao P, Mobbs R. Lumbar Disk Arthroplasty for Degenerative Disk Disease: Literature Review. World Neurosurg. 2018 Jan;109:188-196. [PubMed: 28987839]

Figures

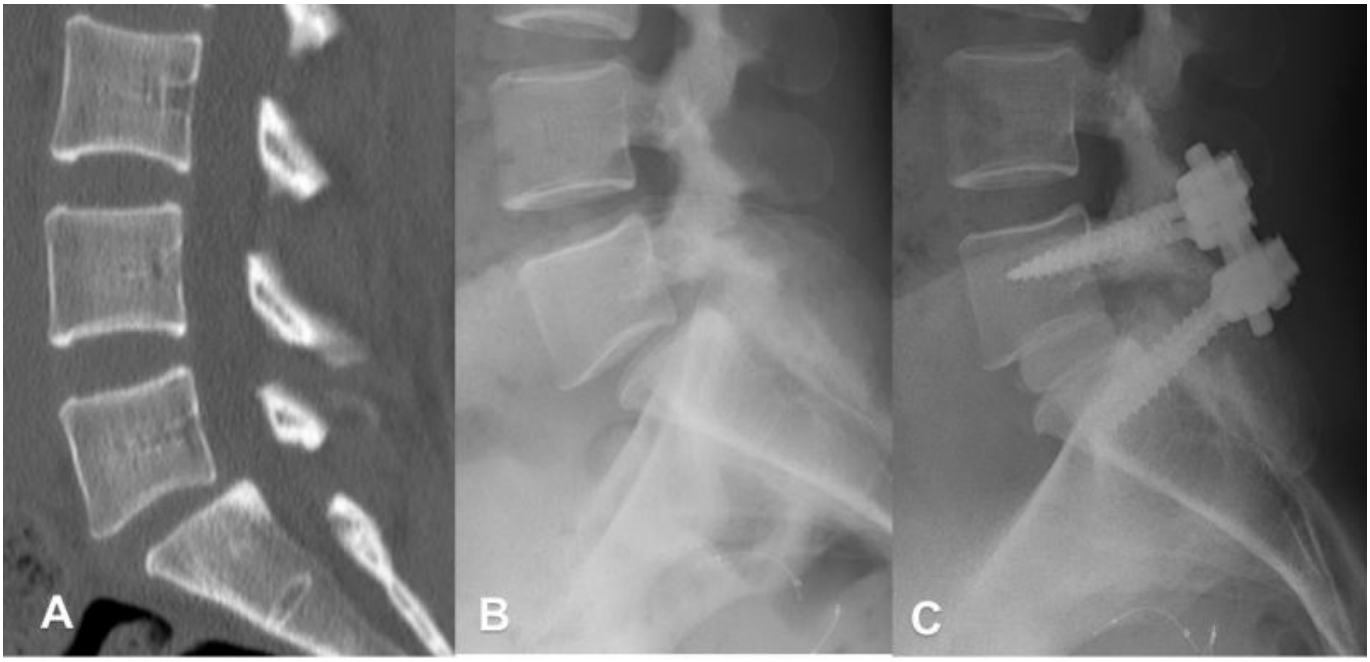

Fig 2. (**A, B, C**) 52 year old male with a degenerative spondylolisthesis at L5 – S1. (A) CT sagittal view of a low grade slip. (B) Lateral radiograph pre-operative intervention. (C) Surgically treated with L5 – S1 decompression, instrumented fusion and placement of an interbody graft between L5 and S1.

Isthmic Spondylolisthesis intervention. Contributed by Chester J Donnally III, MD

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