Understanding and Treating Spondylolysis and Spondylolisthesis

By Tenner Guillaume, M.D., pediatric spine surgeon

When an athletic adolescent experiences low back pain that worsens with back extension, consider evaluating the patient for spondylolysis.

Spondylolysis is an acquired fracture of the pars interarticularis of the vertebrae, but the term can also be used to describe a stress fracture of the pars interarticularis.

Spondylolisthesis refers to a vertebral slip that usually occurs between L5 and S1.

Of the four kinds of spondylolisthesis, only two—dysplastic and isthmic—occur in children and adolescents.

Spondylolysis and spondylolisthesis are common, acquired, secondary to mechanical stress, and more often seen in athletes.

Usually both conditions can be resolved within 12 weeks with rest, physical therapy and bracing.

Spondylolysis can often be resolved with rest, bracing and physical therapy, but 43 to 74 percent of cases of bilateral spondylolysis will progress to spondylolisthesis, a condition in which one of the vertebrae (usually L5) slips forward compared to the next vertebrae (often S1). It is important to note that spondylolisthesis may also develop without a previous history of spondylolysis, but because they are often related, this article will examine the diagnosis and treatment of each condition.

Tenner Guillaume, M.D., is a board-certified orthopedic surgeon who specializes in managing spine conditions such as pediatric congenital and idiopathic scoliosis, spondylolysis and isthmic spondylolisthesis. He received his medical degree from the University of Minnesota Medical School. He completed an internship and residency at the University of California, San Francisco Medical Center and a spine surgery fellowship through the Twin Cities Spine Center in Minneapolis.

He has presented research, posters and abstracts and has professional publications. He is a member of the American Academy of Orthopaedic Surgeons and the North American Spine Society. He is a candidate for membership in the Scoliosis Research Society and the Pediatric Orthopaedic Society of North America.
Making a Differential Diagnosis of Spondylolisthesis

History

Usually patients report low back pain that can be acute or insidious. Because spondylolisthesis is acquired and secondary to mechanical stress, the history should include a discussion of the patient’s physical activities.

Physical Examination

When a thorough history has eliminated red flags such as constitutional symptoms or radiculopathy, the following symptoms point to a high suspicion of spondylolisthesis:

- Your patient experiences pain below the intercrestal line, also called the interarticularis line. (bony edema) at the site of stress. Note the inflammation in the L5 pedicle and posterior elements of the L5-S1 joint. The symptoms suggest an acute exacerbation of his chronic spondylolysis.

- If patients remain pain-free while running, they may participate in running. Patients often become increasingly severe. He said that it was worse when skating.

- The patient’s back for four to six weeks by avoiding sports and other activities that strain it.

- Wear a lumbarlordic brace (LSL). This recommendation depends on acuity, radiographic findings and the patient’s age and willingness to rest. It can be provider dependent.

- After four to six weeks of rest, patients should participate in physical therapy for six weeks. If prescribed, the LSO should be removed during physical therapy, and anterior translation of the lumbar spine should be reduced.

- Given the acuity of the pain onset and the increased signal intensity noted on the MRI, a brace and rest were the best initial treatment.

- If the patient’s back was painful, he could return to sports full time without restrictions.

Management of Spondylolisthesis

For most patients, symptoms tend to resolve within 12 weeks with a regimen of rest and physical therapy:

- For most patients, symptoms tend to resolve within 12 weeks with a regimen of rest and physical therapy.

- There are four types of spondylolisthesis, but only two—dysplastic and isthmic—occur in children and adolescents. Dysplastic spondylolisthesis happens when a congenital deficiency in the L5-S1 joint allows a slippage to occur. A defect in the pars interarticularis leads to isthmic spondylolisthesis, which is the most common type.

History

As with spondylolisthesis, spondylolysis is a more common among children and adolescents whose activities put stress on the lower back and require frequent extensions of the lumbar spine. Asking patients about their physical activities will provide valuable insight.

Spondylolysis and spondylolisthesis are common, acquired, secondary to mechanical stress, and more often seen in athletes. In almost all cases, both conditions can be resolved within 12 weeks with rest, physical therapy and bracing. Very rarely, surgery may be required in order to relieve persistent pain associated with spondylolisthesis.

References


Conclusion

Spondylolysis and spondyloptisis are common, acquired, secondary to mechanical stress, and more often seen in athletes. In almost all cases, both conditions can be resolved within 12 weeks with rest, physical therapy and bracing. Very rarely, surgery may be required in order to relieve persistent pain associated with spondylolisthesis.
Spondylolysis

In this sagittal CT scan, a pars interarticularis disruption (spondylolysis) is evident. This spot lateral radiograph of L5-S1 helps to visualize the defect.

There are four types of spondylolisthesis, but only two—dyplastic and isthmic—occur in children and adolescents. Dysplastic spondylolisthesis happens when a congenital deficiency in the pars interarticularis leads to isthmic spondylolisthesis, which is the most common type.

Fig. 2 - Spondylolysis

Physical Examination

When a thorough history has eliminated red flags such as constitutional symptoms or radiculopathy, the following symptoms point to spondylolysis:

- Pain in the lower back, buttocks, or posterior thighs.
- Pain is the most common presenting symptom of spondylolysis.
- Physical Examination

Check for:
- Postural deformity or abnormal gait resulting from tight hamstring musculature.
- Flatfoot musculature.
- Increased lumbar lordosis.
- A walking gait

Management of Spondylolysis

For most patients, symptoms tend to resolve within 12 weeks with a regimen of rest and physical therapy:

- Rest for the back for four to six weeks by avoiding sports and other activities that strain it.
- Wear a lumbosacral orthosis (LSO). This recommendation depends on acuity, radiographic findings, and the patient’s age and willingness to rest. It can be provided on a trial basis.
- After four to six weeks of rest, patients should participate in physical therapy for six weeks. If prescribed, the LSO should be removed during physical therapy, which should include lumbar core strengthening exercises and hamstring stretching. Avoid active lumbar extension during therapy.
- At the six-week mark, patients may begin a jogging program for two weeks and then progress to running.
- If patients remain pain-free while running, they may resume participating in their sport. However, patients should avoid backward jumps and back somersaults until medical therapy is completed.
- Surgical interventions are rarely needed.

Fig. 1 - Spondylolysis

Making a Differential Diagnosis of Spondylolysis

Spondylolisthesis refers to a vertebral slippage that usually occurs between L5 and S1. Very rarely, it can be present at both levels and remain asymptomatic. Spondylolysis may occur before spondylolisthesis. For example, in cases of bilateral spondylolysis, the posterior articulations may no longer provide posterior stability and anterior slipping of the L5 vertebra over the sacrum can occur. However, approximately one-third of symptomatic patients have spondylolisthesis without spondylolysis.

Conclusion

Spondylolysis and spondylolisthesis are common, acquired, secondary to mechanical stress, and more often seen in athletes. In almost all cases, both conditions can be resolved within 12 weeks with rest, physical therapy and bracing. Very rarely, surgery may be required in order to relieve persistent pain associated with spondylolisthesis.

References


Hockey Player With Spondylolytic Spondylolisthesis

History

This 15-year-old male hockey player was seen in clinic for insidious low back pain which had started three weeks earlier. He reported a history of chronic mild low back pain rated 3/10, with no previous episodes of acute pain. During previous hockey games, he had noted increased low back pain following backward jumps or extension of his hips. He had been sitting out of hockey for two weeks prior to his clinic appointment. While he was bandaged, he noted that the severity of the pain was somewhat reduced. He did not have pain radiating down either lower extremity or any changes in bowel or bladder function. He did not have any associated constitutional symptoms such as fever, chills, night sweats or unintentional weight loss.

Physical examination

The physical examination demonstrated a healthy young male with good bilateral lower extremity strength and sensation without any evidence of upper motor neuron findings such as hyper-reflexia, clonus or Babinski. He did not have much pain during forward flexion of the lumbar spine, but extension acutely increased his low back pain.

AP and L5-S1 spot lateral radiographs were obtained and an L5-S1 grade I spondylolysis and spondylolisthesis was noted. An MRI had been done at another clinic, and increased signal intensity was noted bilaterally on both T2 and T1 (short tau inversion recovery) sequences within the pedicles and pars interarticularis. Those findings support an acute exacerbation of his chronic spondylolysis.

Treatment

Given the acuity of the pain crisis and the increased signal intensity noted on the MRI, a brace and rest were the best initial treatments. Our treatment goals were symptom relief and prevention of future pain recurrences. The patient and his parents understood that union of bone was unlikely.

For the first six weeks of treatment, the patient was expected to wear the brace 23 hours a day, but he could remove it when showering. However, if the pain intensity noted on the MRI, a brace and rest were the best initial treatments. Our treatment goals were symptom relief and prevention of future pain recurrences. The patient and his parents understood that union of bone was unlikely.

After six weeks, he returned to the clinic and his pain was significantly improved. We then initiated a physical therapy program to work on isometric core strengthening and hamstring stretching. The patient was told that he could remove the brace during physical therapy and when sleeping. However, he should wear it at all other times. During an appointment in 6 weeks after treatment was initiated, the patient reported that he had been pain-free for the preceding six weeks. Currently, he was allowed to remove his brace and begin a supervised jogging routine and stretching program for the next four to six weeks. If he remained pain-free, he could return to sports full time without restrictions.

Follow-up

He has now been pain-free for two years, and he has maintained his core strengthening program throughout.
Making a Differential Diagnosis of Spondylolisthesis

Fig. 2 - Spondylolysis
In this sagittal CT scan, a pars interarticularis disruption (spondylolysis) is evident. This 15-year-old male hockey player was seen in clinic for intense low back pain which had started three weeks earlier. He reported a history of chronic low back pain rated as 6/10 with varying activities. However, during recent pressure testing, the pain had become incapacitating. He said that he could not tolerate anything that might aggravate or extend his pain. He had been sitting out of hockey for two weeks prior to his clinic appointment. While he was booked, he noted that the severity of the pain was somewhat reduced. He did not have pain radiating down either lower extremity or any changes in bowel or bladder function. He did have some associated constitutional symptoms such as fevers, night sweats or unintentional weight loss.

Physical examination: The physical examination demonstrated a healthy young male with good bilateral lower extremity strength and sensation without any evidence of upper motor neuron findings such as hyperreflexia, clonus or Babinski. He did not have much pain during forward flexion of the lumbar spine, but extension caused an increase in his low back pain.

AP and L5-S1 spot lateral radiographs were obtained and an L5-S1 Grade I spondylolytic spondylolisthesis was noted. An MRI had been done at another clinic, and increased signal intensity was noted bilaterally on both T2 and T2* (short tau inversion recovery) sequences within the pedicles and pars interarticularis. These findings support an acute exacerbation of his chronic spondylolisthesis.

Treatment
Given the acuity of the pain onset and the increased signal intensity noted on the MRI, a brace and rest were the best initial treatments. Our treatment goals were symptoms relief and prevention of future pain recurrences. The patient and his parents understood that a union of bone was unlikely.

For the first six weeks of treatment, the patient was expected to wear the brace 23 hours a day, but he could remove it whenever he desired. After six weeks, he returned to the clinic and his pain was significantly improved. We then initiated a physical therapy program to work on isometric core strengthening and hamstring stretching. The patient was told that he could remove the brace during physical therapy and when sleeping. However, he should wear it at all other times. During an appointment in weeks after treatment was initiated, the patient reported that he had been pain-free for the preceding six weeks. Consequently, he was allowed to remove his brace and begin a supervised jogging program for the next two to four weeks. If he remained pain-free, he could return to sports full-time without restrictions.

Follow-up
He has now been pain-free for two years, and he has maintained his core strengthening program throughout.

Fig. 3 - Spondylolysis
The spot lateral radiographs demonstrate a Grade I L5-S1 spondylolytic spondylolisthesis.

Fig. 4 – Acute spondylolysis
The sagittal MRI (STIR sequence) demonstrates the increased signal intensity (bony edema) at the site of stress. Note the inflammation of the L5 pedicle and pars interarticularis that is associated with an acute spondylolysis.

There are four types of spondylolisthesis, but only two—dyplastic and infantile—occur in children and adolescents. Dyplastic spondylolisthesis happens when a congruent deficiency in the L-5-S1 facet joints allows a slippage to occur. A defect in the pars interarticularis leads to isthmic spondylolisthesis, which is the most common type.

History
As with spondylolysis, spondylolisthesis is more common among children and adolescents whose activities put stress on the lower back and require frequent extensions of the lumbar spine. Asking patients about their physical activities will provide valuable insight.

Pain is the most common presenting symptom of spondylolysis. It manifests as a dull, aching low-back discomfort, either localized to the low back or with some radiation into the buttocks and posterior thighs.

Management of Spondylolysis

For most patients, symptoms tend to resolve within 12 weeks with a regimen of rest and physical therapy.

• Rest the back for four to six weeks by avoiding sports and other activities that strain it.

• Wear a lumbar corset orthosis (LSO). This recommendation depends on acuity, radiographic findings and the patient’s age and willingness to rest. It can be provider dependent.

• After four to six weeks of rest, patients should participate in physical therapy for six weeks. If prescribed, the LSO should be removed during physical therapy, which should include lumbar core strengthening exercises and hamstring stretching. Avoid active lumbar extension during therapy.

• At 12 weeks, patients may begin a jogging program for two weeks and then progress to running. If patients remain pain-free while running, they may resume participating in their sport. However, posterior facet joint can bear additional weight and back hunching during physical therapy is common.

Surgical interventions are rarely needed.

Conclusion
Spondylolysis and spondylolisthesis are common, acquired, secondary to mechanical stress, and more often seen in athletes. In almost all cases, both conditions can be resolved within 12 weeks with rest, physical therapy and brace. Very rarely, surgery may be required in order to relieve persistent pain associated with spondylolisthesis.

References

Management of Spondylolysis

The history usually shows low back pain that can be acute or insidious. Because spondylolysis is acquired and secondary to mechanical stress, the history should include a discussion of the patient’s physical activities.

Physical Examination
When a thorough history has eliminated red flags such as constitutional symptoms or radiculopathy, the following symptoms or signs should be assessed at the initial visit. If the patient remains pain-free while running, they may return to their sport.

• Flattening of the buttocks
• A waddling gait
• Postural deformity or abnormal gait resulting from tight hamstrings

Patients who have radiating symptoms suggestive of nerve root compression or radiculopathy should be referred to a spine specialist promptly. When there is no sign of sciatic neuropathy, it is appropriate to manage patients who have spondylolysis with simple rest. However, if rest for four to six weeks does not resolve pain and other symptoms, please refer patients suspected of having spondylolysis to one of our spine specialists. Gillette’s spine specialists welcome your questions, requests for consultation and referrals regarding any patient who is suspected of having spondylolysis or spondylolisthesis.
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Spondylolysis is an acquired fracture of the pars interarticularis of the vertebrae, but the term can also be used to describe a stress fracture of the pars interarticularis of the vertebral spinous process. The defect can be unilateral or bilateral and may occur at any level, but it is most commonly seen at L5. Spondylolysis affects 6 percent of people by age 18. When it is symptomatic, it is a painful condition that can sideline gymnasts, offensive linemen, ballet dancers, divers or any other athlete whose sport calls for hyperextension. The incidence in athletes is 11 percent compared to 3 percent among nonathletes.2,3 As many as 11 percent of female gymnasts may experience spondylolysis.4

Spondylolysis can often be resolved with rest, bracing and physical therapy, but 43 to 74 percent of cases of bilateral spondylolysis will progress to spondylolisthesis,5,6 a condition in which one of the vertebrae (usually L5) slips forward over the next vertebra (often S1). It is important to note that spondylolysis may also develop without a previous history of spondylolysis, but because they are often related, this article will examine the diagnosis and treatment of both conditions.

Of the four kinds of spondylolisthesis, only two—dysplastic and isthmic—are commonly recognized, secondary to mechanical stress, and more often seen in athletes.7 Usually both conditions can be resolved within 12 weeks with rest, physical therapy and bracing.

Tenner Guillaume, M.D., is a board-certified orthopedic surgeon who specializes in managing spine conditions such as pediatric congenital and idiopathic scoliosis, spondylolysis and isthmic spondylolisthesis. He received his medical degree from the University of Minnesota Medical School. He completed an internship and residency at the University of California, San Francisco Medical Center and a spine fellowship at the University of Minnesota Medical School. As a pediatric spine surgeon who specializes in managing spine conditions such as pediatric congenital and idiopathic scoliosis, spondylolysis and isthmic spondylolisthesis, he has presented research, posters and abstracts and has published several articles in the medical literature.

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Spondylolysis can often be resolved with rest, bracing and physical therapy, but 43 to 74 percent of cases of bilateral spondylolysis will progress to spondylolisthesis2, which is a slip that usually occurs between L5 and S1. Of the four kinds of spondylolisthesis, only two—dysplastic and isthmic—are common, acquired, secondary to mechanical stress, and more often seen in athletes.

Usually both conditions can be resolved within 12 weeks with rest, physical therapy and bracing.

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Learn more about complex movement disorders and the spectrum of treatments available.

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Spondylolysis and Spondylolisthesis

KEY INSIGHTS

- Spondylolysis is an acquired fracture of the pars interarticularis of the vertebra, but the term can also be used to describe a stress fracture of the pars interarticularis. Spondylolysis affects 6 percent of people by age 18. When it is symptomatic, it is a painful condition that can sideline gymnasts, offensive linemen, ballet dancers, divers or any other athlete whose sport calls for hyperextension. The incidence in athletes is 11 percent compared to 3 percent among nonathletes. As many as 12 percent of female gymnasts may experience spondylolysis.

- Spondylolysis can often be resolved with rest, bracing and physical therapy, but 43 to 74 percent of cases of bilateral spondylolysis will progress to spondylolisthesis, a condition in which one of the vertebrae (usually L5) slips forward compared to the next vertebrae (often S1). It is important to note that spondylolisthesis may also develop without a previous history of spondylolysis, but because they are often related, this article will examine the diagnosis and treatment of each condition.

Fig. 1a - Pars Interarticularis

Fig. 1b - Pars Interarticularis With Spondylolysis

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