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Current Clinical Concepts: Management of Common Lumbar Spine Posterior Column Disorders in Young, Active Individuals

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Although posterior column disorders, such as spondylolysis and spondylolisthesis, are not commonly encountered in the general population, athletic trainers frequently see these conditions in athletic and active individuals due to the repetitive spinal extension and rotational loads placed on the pars interarticularis while participating in sport. Athletic trainers can successfully evaluate patients with posterior column disorders by performing a complete and comprehensive clinical examination to identify the location of pain, test spinal stability, and recognize compensatory movement patterns. Conservative management typically leads to a successful outcome in this population, with rest, bracing, and the use of therapeutic exercise having the best supporting evidence. In this Current Clinical Concepts review, we outlined the etiology and risk factors frequently associated with disorders of the posterior column. Additionally, we synthesized the literature for common evaluation techniques and interventions associated with the posterior column and provided a proposed rehabilitation progression to use in a younger, athletic population.

Key Words: spondylolysis, spondylolisthesis, bracing, therapeutic exercise

Key Points

- Although the incidence of posterior column disorders in the general population is low, the repetitive stresses incurred during athletics result in competitive athletes being at a 3 times higher risk for developing the condition.
- Some patients with persistent symptoms require additional intervention, yet high-quality, consistent evidence indicated that conservative treatments, including rest, the use of a brace, and therapeutic exercise, can restore full or nearly full function.

Consistent return-to-play criteria and progressions for posterior column disorders of the lumbar spine are lacking, and recovery times can range from 4 weeks to 12 months. These disorders include conditions such as spondylolysis and spondylolisthesis, which are acquired or traumatic fractures in the *pars interarticularis*, the small isthmus of bone between the inferior and superior articular facets of the spinal vertebrae. The fractures are typically separated into 5 categories (Table 1).[1] Compared with *spondylolysis*, which is a unilateral pars fracture, *spondylolisthesis* is a bilateral fracture that can cause anterior (*anterolisthesis*) or posterior (*retrolisthesis*) migration of 1 vertebral body over its inferior counterpart. Type II spondylolysis and spondylolisthesis fractures most commonly occur at the L4 and L5 vertebrae[2–5] and are usually seen in younger athletic individuals. Degenerative conditions of the pars (type III fractures) frequently occur in patients presenting with chronic low back pain; increased age is a significant factor in the prevalence of these fractures.[3] Type III fractures are generally not seen in a young athletic population but may be encountered by athletic trainers (ATs) who work in a clinic as opposed to a more traditional sport setting. The focus of our article was the evaluation and management of type II posterior column fractures in younger athletic individuals.

Among adolescent athletes, spondylolysis and spondylolisthesis have been reported to account for 47% of lumbar pain.[6] Sex appeared to be an intrinsic risk factor as spondylolysis occurred 1.5 to 2 times as often in males as in females,[5] whereas spondylolisthesis was up to 5 times more common in women due to factors such as pregnancy, higher body mass index, generalized joint laxity, and hormones.[7] Ethnicity also appeared to play a role in the incidence of spondylolysis. In a study[8] of cadaver skeletons, prevalence rates of 6.4% were found in White men, 2.8% in Black men, 2.3% in White women, and 1.1% in Black women. Other investigations[8–11] of Japanese (5.9%), Korean (9%), and Canadian Inuit (50%) populations indicated large variations in spondylolysis rates among different ethnic groups.

Extrinsic risk factors for injury include mechanical load, rapid growth, and sport participation. At birth, the prevalence rate was nearly 0%,[9] reflecting that spondylolysis is a condition acquired through mechanical stresses and loading of the pars interarticularis with repeated spinal motions, typically those involving hyperextension and rotation.[5] Young athletes who participated in sports such

Table 1. The Wiltse-Newman Classification System[1] for Fractures of the Pars Interarticularis

Type and Subtype	Description
I	Dysplastic: Due to congenital abnormalities of the upper sacrum or L5 neural arch.
II	Isthmic: The result of a stress fracture or acute fracture causing translation of the vertebral body.
A	Lytic or fatigue: The defect is caused by load (repeated extension and/or rotation). The most common type of defect in patients under the age of 50.
B	Elongation: The observed pars defect is intact but appears secondary to repeated fatigue microfractures and heals in an elongated position.
C	Acute: The observed pars fracture is secondary to a single-event severe trauma. This is a rare fracture.
III	Degenerative: The result of chronic lumbar segmental instability. This is rarely seen in patients before the age of 40 to 50.
IV	Traumatic: The fracture is observed in a location other than the pars interarticularis, leading to vertebral body translation.
V	Pathological: Due to bony tumors and/or infections, resulting in lesions formed within the pars interarticularis.

as diving, weight lifting, wrestling, and/or gymnastics displayed a group incidence of spondylolysis as high as 15%, 3 times greater than the general population.[12] Until bony ossification of the apophyseal ring onto the vertebral body occurs, the vertebra can migrate along the growth plate.[13] Because high levels of sport participation often take place during adolescent growth spurts, the immature growth plate is subject to increased risk in the posterior column.[14] Increasing age and high training loads of >15 hours per week during growth correlated positively with spondylolytic changes,[15] perhaps due to greater overload on the spine, improper lifting technique, poorly chosen training loads, or a lack of qualified adult supervision, highlighting the need for proper training and conditioning in this population. However, even highly trained elite athletes with access to proper training and recovery strategies have demonstrated a higher incidence rate of posterior column disorders. Of 2965 athletes who attended a National Football League Scouting Combine between 2003 and 2011, a total of 414 players (14%) had a preexisting lumbar spine diagnosis, including 321 (10.8%) who had a posterior column defect,[16] a prevalence rate approximately twice as high as in the general population.

Type II spondylolisthesis defects appear mostly in athletes. In major and minor league baseball players, where batting and pitching movements load the lumbar spine in both rotation and hyperextension, 28 of 75 players with a pars fracture were diagnosed with isthmic spondylolisthesis.[17] These athletes tended to be older and have more baseball experience, suggesting that repetitive loading over time was a contributing factor. Spondylolisthesis defects are classified based on the percentage of translation between the superior and interior vertebrae as observed on a lateral radiograph. The Meyerding classification system[18] is commonly used to grade the degree of translation and is divided into 5 parts. Grade I is *translation of the superior vertebra of < 25%*, grade II is *25% to 50%*, grade III is *50% to 75%*, and grade IV is *up to 100%*. Grade V is *complete translation of the superior vertebra off the inferior segment*, or *spondyloptosis*; this is a rare injury in sports and usually results from a high-velocity injury.[19]

In many sport settings, ATs are generally among the first medical providers consulted when athletes experience low back pain. Because conditions of the posterior column are frequent, it is important for the AT to be well equipped to evaluate and manage patients with this condition. For this review, we synthesized and evaluated the recently published evidence supporting the evaluation and management recommendations for athletic posterior column fractures using the Strength of Recommendation (SOR) taxonomy, with ratings of A, B, or C assigned where clinical recommendations could be made. Ratings were as follows: A, *consistent, good-quality, patient-oriented evidence*; B, *inconsistent or limited-quality patient-oriented evidence*; and C, *evidence based on consensus, usual practice, opinion, or disease-oriented evidence*.[20]

EVALUATION

When patients present for evaluation of low back pain, it is imperative that a thorough history and physical examination be completed to ensure early diagnosis and establish a treatment plan.[21–23] The physical examination should include appropriate patient observation, palpation, selective tissue tension testing, neurologic examination, special tests, and, in some cases, diagnostic imaging.

History

Posterior column disorders characteristically present with an insidious onset of pain and a duration of ≥3 weeks[12,24] in individuals older than 10 years of age and may have coincided with rapid growth or puberty.[12,13] Although the condition can develop in any population subjected to repeated compressive stresses on the pars interarticularis, 3 classic types of patient presentations have been described: (1) a female gymnast or dancer with hypermobility, increased flexibility, and an increased lumbar lordotic posture; (2) a strong man in peak growth velocity with limited flexibility and tight spinal erectors; and (3) an athlete who recently began vigorous sport participation with no conditioning.[12] Typical presentations of posterior column disorders include complaints of pain after repeated extension or rotation of the lumbar spine, often described as a dull ache or a severe sharp pain, that is alleviated with rest.[5,12,13,21,22] Pain that does not resolve with rest may indicate possible spondylolisthesis, as these patients more often report difficulty falling asleep, waking up due to pain, and pain that is worse while sitting or walking.[25] When questioning an individual, symptoms that deserve particular attention include a history of low back pain triggered by hyperextension or rotation with regular intake of over-the-counter anti-inflammatory medication.[12] *SOR: C*

Observation and Palpation

Patients with posterior column disorders usually display normal gait unless they are compromised by pain, which is characterized by a forward lean, shortened stride length, and flexion of the hips and knees secondary to hamstrings contracture.[12,13,24] This classic bent-knee, hip-flexed posture, called the Phalen-Dickson sign (Figure 1),[13,26] is

Figure 1. The Phalen-Dickson sign demonstrates the bent-knee, hip-flexed posture common in patients with high-grade spondylolisthesis during sit-to-stand transfers and ambulation.

Figure 2. The stork test is performed by standing on 1 leg and extending the lumbar spine. Pain during the movement is a positive sign for an ipsilateral spondylolysis.

common in patients with spondylolisthesis during sit-to-stand and ambulation. In individuals with advanced spondylolisthesis, a visible step-off may be seen along the lumbar spinous processes.[13,22,24] Palpation of the step-off deformity demonstrated diagnostic utility in the general population but has not yet been investigated in a young or athletic population.[27] *SOR: C*

Selective Tissue Tension Testing

Patients with posterior column disorders often experience limitations in their lumbar spine and hip range of motion due to pain or muscle tightness. Active or passive extension of the spine frequently elicits pain. Pain may also occur during resistive range of motion from flexion into extension,[12,13,21,24] and individuals often demonstrate tightness of the hamstrings and occasionally the hip flexors.[5,12,21,28] They may display hypermobility of the affected lumbar spinal segments, with hypomobility of adjacent segments and corresponding weakness of the abdominal and gluteal muscles.[5,12,28] *SOR: C*

Neurologic Examination

Generally, neurologic testing is normal in patients with posterior column disorders.[12] However, individuals who present with advanced cases or lower extremity radicular pain, altered sensation, weakness, or bowel or bladder disturbance need diagnostic imaging via a physician.[9,24] In 1 study,[29] radicular symptoms appeared to be more prevalent ($P < .01$) in participants with pars fractures who exhibited vertebral instabilities (52 of 84 patients with radicular symptoms, 61.9%) than those with pars fractures who did not have an instability present (16 of 76 patients, 21.1%). *SOR: C*

Special Tests

With varying levels of success, an assortment of special tests has been used to provoke a pain response by loading the possible pars fracture, detect motor control between the trunk and lower extremity, or assess instability in the vertebral column in young active individuals. One of the most common orthopaedic special tests is the stork test, or single-legged hyperextension test (Figure 2). Despite its frequent use, the stork test had low utility in detecting an active spondylolysis in a population of young active individuals with low back pain: sensitivity = 0.50, specificity = 0.46, positive likelihood ratio = 1.01, and negative likelihood ratio = 0.74.[5,22,25,30] In the face of this evidence, clinicians should question the utility of the stork test and consider other assessments. The active straight-leg raise test has been used to assess lumbopelvic motor control (Figure 3). It is widely thought to be a valid and reliable tool, with sensitivity of 0.87, specificity of 0.94, a positive likelihood ratio of 16.17, and a negative likelihood ratio of

Figure 3. For the active straight-leg raise test, the supine patient is asked to lift the leg approximately 20 cm off the table. Any pain or weakness reflects his or her ability to transfer force through the lumbopelvic complex. Differences between the legs are noted on a 5-point scale.

0.03 in women with lumbopelvic pain of various causes and degrees of severity.[13,31,32] Clinicians might choose the active straight-leg raise test to assess the patient's ability to transfer load between the spine and lower extremities. The passive lumbar-extension test (Figure 4) assesses segmental lumbar instability and had reported sensitivity of 0.84, specificity of 0.90, a positive likelihood ratio of 8.84, and a negative likelihood ratio of 0.17.[25,32,33] Some believe the passive lumbar-extension test is the most accurate method for detecting structural instabilities in the spine to predict an unstable spondylolisthesis.[31] The prone instability test (Figure 5) also evaluates segmental lumbar instability and is more often positive in patients with chronic pain. Its sensitivity of 0.44, specificity of 0.45, positive likelihood ratio of 0.80, and negative likelihood ratio of 1.24 give it limited diagnostic use as an independent test.[31] However, as

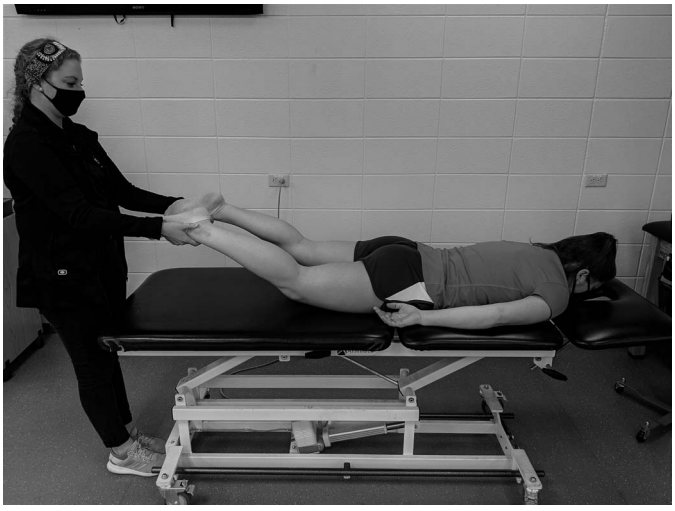

Figure 4. The passive lumbar-extension test is performed in the prone position by lifting the patient's legs off the table sufficiently to bring the lumbar spine into extension while the examiner provides a traction force. A positive test that reproduces pain indicates spondylolisthesis.

Figure 5. For the prone instability test, the patient is prone with the feet over the table touching the floor. A, The clinician applies pressure to each lumbar segment. B, If pain results, the patient is asked to raise both legs off the floor, and the pressure is reapplied. Pain that is relieved when the patient lifts the feet from the floor indicates lumbar spine instability.

a component of the lumbar-stabilization clinical prediction rule, the prone instability test may help to predict the response to therapeutic exercises.[31,34] *SOR: C*

Diagnostic Imaging

If a posterior column disorder is suspected on physical examination, imaging may be used to confirm its presence or absence.[28] Yet diagnostic imaging is often overused for nonspecific low back pain and is not always necessary for successful management. In fact, when the patient presents with the signs and symptoms of a posterior column disorder, it is appropriate to begin treatment in the absence of diagnostic imaging. The most common diagnostic imaging techniques used to detect posterior column disorders are radiographs, computed tomography (CT), magnetic resonance imaging (MRI), single-photon emission computerized tomography (SPECT), and bone scintigraphy.[22] No widely accepted criterion standard exists for radiographic diagnosis,[12,23,28] though the North American Spine Society "Clinical Guidelines for Multidisciplinary Spine Care Report"[22] designated lateral radiographs and

MRI as the most effective imaging tools for diagnosing spondylolisthesis, and CT was regarded as effective when MRI was contraindicated. When radiographs were the only diagnostic tool available, several research groups[5,21,23] observed that lateral radiographs combined with anteroposterior and 45° left and right oblique (where the visual aid "Scottie dog" could be seen) views revealed 96.5% of pars defects. *SOR: C*

MANAGEMENT

For most patients, conservative measures should be exhausted before considering surgical options. Conservative measures typically include medication, varying durations of rest, different forms of bracing, and skilled therapeutic exercise. Oftentimes, individuals are prescribed multiple conservative measures concurrently because there is no universal agreement as to which measures are most effective.[5]

Medication

Whether nonselective nonsteroidal anti-inflammatory drugs and selective cyclo-oxygenase (COX)-2 inhibitors should be used as anti-inflammatory or analgesic medications in patients after a fracture or stress fracture is inconclusive. These drugs may interfere with prostaglandin production, thereby impairing the inflammatory reaction after a bony fracture. An animal study[35] suggested that the effects of COX-2 inhibitors depended on the timing, duration, and dosage. Physicians may consider a short course of anti-inflammatory medications for pain management in individuals with posterior column disorders but may also want to avoid these in those at risk for delayed fracture healing. Oral corticosteroid medication may be tried depending on patient symptoms and physician preferences. Medications such as prednisone and methylprednisone are frequently administered, but outcomes have not been widely published, and long-term administration of glucocorticoids inhibited the bony healing process in mice.[36] Spinal injections of various types (eg, interlaminar and transforaminal epidural) have increased in popularity as nonoperative treatment options for athletes with symptomatic low back pain, such as lumbar disc herniation.[37] Spinal injections for the posterior column disorder of a young athlete should only be performed by an experienced physician when there is a proven chronic, nonunion injury in the pars interarticularis to avoid problems with bony healing and only after a detailed discussion of risks and benefits has occurred. As with all therapeutic interventions, ATs should be aware of the potential risks and benefits associated with each medication offered. *SOR: C*

Rest and Bracing

One of the most common forms of conservative care prescribed by physicians is rest with use of a brace to help achieve bony union of the pars fracture.[4,38] Some have suggested patients should rest from sports activities for at least 3 months,[12,39] but for highly competitive and active individuals participating in sport, this may not be feasible, and the amount of rest can vary from 2 weeks to 6 months depending on symptom severity.[5] Although rest is typically recommended for all individuals with a posterior column disorder, it may have the highest utility in those with symptomatic spondylolysis and grade I spondylolisthesis. Investigators[40] found that after 6 weeks of activity modification, Oswestry Disability Questionnaire scores indicated that 18 of 23 (78%) patients had no pain or limitation of function, 22 of 23 (96%) had minimal disability, and only 1 of 23 (4%) had moderate disability. Bracing of the lumbar spine was also a frequent intervention for adolescent athletes,[31,39] despite being criticized by clinicians and patients as expensive and uncomfortable. It is thought a brace would help reinforce proper movement patterns, limit aberrant spinal movements, and serve as an external signal to remind the patient and others of the injury. Despite the possible benefits, wearing a brace could be counterproductive to the concurrent rehabilitation and exercise programs usually prescribed.[40] Regardless of these concerns, several investigators demonstrated the effectiveness of a lumbar spine brace. Among participants who wore a lumbar spine brace that limited lordosis until pain disappeared, 87% were able to return to sport between 1 and 16 months.[41] Another group found that 80% of their patients with a diagnosis of spondylolysis had good to excellent results with full return to sports after 6 weeks of wearing a brace.[42] It is important to note that neither study included a control group for comparison, so the improvements could have reflected the effect of rest alone, wearing the brace, or the combined effect of rest while wearing the brace. Clinicians should use good clinical judgement and practice principles of patient-centered care when making decisions about the use of rest and a brace to treat disorders of the posterior column. *SOR: A*

Therapeutic Exercise

Many acute posterior column conditions do not heal radiographically, yet in 1 meta-analysis[43] of 15 observational studies in children and young adults with spondylolysis, nearly 84% of individuals had a successful clinical outcome after rehabilitation. A retrospective investigation[44] of patients aged 5 to 21 diagnosed with spondylolysis with an average follow-up of 8 years showed that 90% of individuals self-reported a return to sport, 78% described low levels of pain ($\leq$3 out of 10), and 58% indicated no pain. These results suggested that patients can successfully rehabilitate this condition through focused therapeutic exercise and generic aerobic exercise. The authors[28] of a literature review found that several studies of different spine conditions, including posterior column disorders, supported the use of core-strengthening exercises, specifically exercises activating and isolating the transverse abdominis, internal oblique, and multifidi to structurally stabilize the lumbar segments. These deep abdominal muscles and the lumbar multifidus are particularly relevant to those with posterior column instabilities due to their effects on intra-abdominal pressure and lumbar stability via cocontraction. Other researchers[40,45,46] noted that lumbar-stabilization exercises were an effective treatment option for controlling pain and improving function in young athletic patients diagnosed with posterior column disorders. A focused therapeutic exercise program should help improve function and return a significant majority of athletes to sport competition. *SOR: A*

Proposed Management Protocol

As part of the effort to engage in injury prevention, ATs should try to identify individuals at high risk of developing a posterior column disorder. Those who participate in sports such as gymnastics, wrestling, swimming and diving, dance, crew, or high jump, in which incidence rates are highest, would benefit from patient education on proper biomechanics and movement patterns for their sport. In these populations, screening to address possible muscle length-tension imbalances, strength deficiencies, or poor movement and training habits may help prevent the condition altogether.

For those who become symptomatic, comprehensive management often includes multiple interventions, typically starting with activity modifications or restrictions, bracing, targeted therapeutic exercise, and patient education. For less severe conditions, relative rest and activity modifications may be appropriate. In those with more significant disorders or who display segment displacement (spondylolisthesis), an antilordotic modified Boston brace should be used. The length of time in the brace will depend on many factors, but practitioners should account for the findings of diagnostic imaging, the patient's reported pain, and the patient's clinical presentation and continue bracing at least until metabolic activity is no longer noted on the SPECT bone scan. Whether or not a brace is used, the individual should be educated on body mechanics, proper lifting techniques, and avoiding spinal motions such as rotation and hyperextension that can delay or prevent healing.

A targeted and progressive therapeutic exercise program should be initiated to address motor control and strength of the abdominal musculature and spinal stabilizers. In general, we recommend a 5-part exercise progression before a return to sport or activity is considered (Table 2). This generic progression can be used for any type of posterior column fracture. However, the more involved or severe the condition, the longer the recovery process may be for the patient.

It is common for patients to continue wearing their brace while initiating therapeutic exercise. They should be allowed to perform their exercises outside of the brace and then resume wearing it during activities of daily living until discontinued by a physician. Step 1 in the progression involves exercises that are isometric and static in nature. These emphasize proper mechanics, spinal positions, and breathing patterns. Once static stability of the spine is achieved, step 2 introduces dynamic movements of the extremities to increase the load on the trunk while the patient maintains a static spine position. This stage is critical for teaching patients how to dissociate movement in the extremities from the trunk. This stage is also typically when cardiovascular aerobic exercise, such as stationary cycling, may be resumed. Once the person is strong enough to control a neutral spine independent of movement across the extremities, progression into step 3 occurs, and dynamic spinal movements are begun. It is important for patients to focus on proper movement patterns and mechanics during this portion of the progression. When they can maintain neutral spine mechanics during movement, step 4 involves neuroreactive and plyometric activities. The intensity of activity and number of foot contacts should be carefully monitored to avoid potential setbacks in the recovery. Step 5 advances to more sport-specific or functional activities to directly mimic the activities the patient will return to on release from care.

Table 2. Sample Rehabilitation Protocol for a Patient With Posterior Column Disorder

Stage	Therapeutic Exercise Options
1: Static spine	• Antilordotic modified Boston brace and rest from sport activities for 2 wk to 6 mo • Abdominal bracing, pelvic-tilt exercises • Front plank: wall-to-floor progression • Supine bridge: static hold • Side plank: wall-to-floor progression
2: Static spine, dynamic extremities	• Antilordotic modified Boston brace and rest from sport activities for 2 wk to 6 mo • Dead-bug exercise progression • Front plank: reaching activities and weight drags • Quadruped: alternate arm raise, alternate leg raise, alternating arm and leg raise • Supine bridge: alternate leg extensions, leg swings • Side plank: hip abduction, elbow taps to knee • Pallof press: tall kneeling to half kneeling to bilateral, tandem, or unilateral stance
3: Dynamic spine or dynamic extremities	• Front plank: side-to-side, cephal to caudal, circumduction, hip hinge kip • Side plank: quarter rotation • Lunges: forward, lateral, reverse • Monster walks: forward, reverse, lateral • Romanian dead lifts: bilateral to single leg, windmill
4: Reactive activities and plyometric integration	• Perturbation and proprioceptive neuromuscular facilitation rhythmic stabilization exercises: bridge, front and side plank with unstable surfaces and/or external loads • Ball tosses with rebounder: kneeling positions to standing postures, including overhead • Plyometric push-ups: push-up walks, medicine ball, unstable surfaces • Lunges: banded acceleration and deceleration, lateral and diagonal jumping • Box jumping and landing exercise progressions • Marching or skipping activities
5: Sport-specific activities	• Progressive loading consistent with demands of sports activities • Return-to-play or competition criteria • Nontender to palpation • Full pain-free or nearly pain-free range of motion • Normal strength and appropriate aerobic fitness • Adequate spinal awareness and movement mechanics • Able to perform sport-specific activities without pain • If grade II segmental migration is present, return to high-risk sports (eg, gymnastics, diving) should be restricted

Table 3. Conservative Interventions for Posterior Column Disorders and Strength of Recommendation

Intervention	Evidence	Strength of Recommendation[20]
Hip mobilization[51,52]	• The hip can contribute to low back dysfunction by altering loads placed on the pars interarticularis • Some evidence of success when integrated into a comprehensive rehabilitation program in patients with spinal stenosis	B[a]
Bone growth stimulator[53]	• Limited evidence; combining stimulator with bracing and exercise demonstrated inconsistent success in resolving pars defect	C
Electrical stimulation[54]	• No reports published specific to posterior column disorders; evidence comes from patients with nonspecific low back pain • Interferential current stimulation combined with spinal-stabilization exercise ↓ pain more than other current types (TENS, high-voltage unit)	B
Kinesio taping[55,56]	• Conflicting evidence of efficacy • May have short-term effect on chronic low back pain but lacks evidence of long-term benefit	B
Instrument-assisted soft tissue mobilization[57,58]	• Effective in ↓ pain and ↑ patient-reported function in those with low back pain • No published reports specific to posterior column	B
Dry needling[59,60]	• Appeared to ↓ intensity of low back pain • Unknown how intervention compares with other treatments; follow-up effects unknown	B
Cupping[61,62]	• May be effective for ↓ pain in patients with nonspecific low back pain; however, overall effectiveness limited by low quality of evidence	B

Abbreviation: TENS, transcutaneous electrical nerve stimulation.

[a] Strength of recommendation ratings: A, consistent, good-quality, patient-oriented evidence; B, inconsistent or limited-quality patient-oriented evidence; C, evidence based on consensus, usual practice, opinion, or disease-oriented evidence.

Intensity should be carefully observed for return of symptoms during each stage of recovery, but particularly in step 5, as repetitive stress and intensity are increased.

The time required to return to play can vary significantly and must be tailored to the patient and the severity and symptoms present. Criteria for a return-to-play decision in competitive athletes were lacking and inconsistent across studies. The majority of the reported criteria were subjective or based on time, diagnostic imaging, or patient symptoms. These included full range of motion, normal strength, appropriate aerobic fitness, adequate flexibility and movement, lack of tenderness to palpation, and completion of a functional activity progression without pain.[47]

Patients who have an extended recovery or who are unable to see progress during their recovery can experience nonphysiological symptoms such as fear avoidance and pain catastrophizing. The biopsychosocial model has been a popular way of contextualizing the interaction of the biological system with the psychological system in different social situations, factors, or constructs. Although conservative care with rest, brace use, and therapeutic exercise was typically an effective treatment strategy, in some research on patients with posterior column disorders, the investigators focused on fear-avoidance and pain-catastrophizing treatments as opposed to traditional strengthening exercises. The results from this approach were equivalent to those of traditional rehabilitation programs.[48–50] These studies were conducted mostly in older populations with chronic degenerative spondylolisthesis, yet they cast an interesting light on the potential application in a younger, competitive athletic population.

Other Conservative Treatments

Several other treatments have been used or suggested by sports medicine professionals to help manage those with posterior column disorders or nonspecific low back pain. A summary of additional conservative treatments with SOR grades is presented in Table 3. Many of these treatments lacked consistent findings in patients with posterior column disorders.

Surgical Intervention

Most individuals with lumbar spine posterior column disorders respond well to conservative measures. However, some continue to have pain and disability: 42% of 1 sample reported low levels of continued pain after conservative treatment, and 67% described enough pain to interfere with activities.[44] Some experts[63] have recommended surgical intervention for those who are athletes, have low back pain that persists for 6 to 12 months, and have documented nonunion of the pars interarticularis or in those whose pain did not resolve after rest and immobilization in a brace. A detailed survey of the different surgical interventions performed by orthopaedic surgeons was beyond the scope of this review. However, common surgical procedures include surgical fixation, decompression via laminectomy, bone grafting of the fracture site, or a lumbar fusion, depending on the degree of instability present. The authors[51] of a systematic review of 13 studies of patients who underwent surgical treatment found that 87.8% had a successful outcome and returned to sport 6 to 12 months after their surgery. Most of the surgeons limited participation in collision sports after surgery.[51] Appropriate surgical care may allow individuals who do not respond to conservative measures to achieve positive outcomes and return to competition.

SUMMARY

Posterior column disorders of the spine can be debilitating conditions that affect sport participation. Although the incidence of these conditions is low overall in the general

population, the cumulative load and stress placed on the pars interarticularis during sports puts competitive athletes at great risk for developing the condition. Therefore, ATs must be aware of the condition and perform a timely and comprehensive evaluation to diagnose it accurately. Conservative treatment and interventions provide the patient with a good chance of full recovery. The combination of rest, bracing, and therapeutic exercise had the best and most consistent evidence, whereas several additional treatments commonly used in sports medicine resulted in inconsistent findings. We proposed a management protocol integrating the best evidence. Surgical management is typically reserved for those with persistent symptoms after conservative care or a documented nonunion of the pars interarticularis.

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