

[Primary Care Sports Medicine]



Evaluation of Low Back Pain in Athletes

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Context: Low back pain is a common complaint in athletes. Athletes differ from the general population physiologically, making it unclear if the evaluation of low back pain should differ between these 2 groups.

Evidence Acquisition: A literature search (PubMed, Ovid) was performed for the years 1995 through 2010. Keywords used were *lumbar back pain*, *athletes*, and *adolescence*.

Results: Athletes with low back pain represent a very diverse group. The evaluation depends on the athlete's age and the presence of "red flags." The most common causes of low back pain in the preadolescent population are infection, tumor, and trauma. In the adolescent population, trauma spondylolysis/spondylolisthesis and hyperlordosis are commonly seen. Leading causes in the adult population are mechanics and osteoarthritis. The elderly frequently present with osteoarthritis, spinal stenosis, and internal medical etiologies.

Conclusion: Athletes with back pain should have a diagnostic workup guided by their age, history, and physical examination. Although this work up is similar in nonathletes, the demands of the athlete must be taken into account in a treatment plan.

Keywords: lumbar back pain; athletes; inflammatory back pain; evaluation of lumbar back pain

Low back pain (LBP) is a common symptom but is not a diagnosis. In most cases, patients with LBP do not have an anatomical abnormality.^{16,27,38}

A Scandinavian survey of more than 5000 young adults revealed that 7% of 12-year-olds and 53% of 18-year-olds have experienced at least 1 episode of LBP in their lifetime.⁸ The lifetime prevalence of LBP in the general adult population is estimated to be between 85% and 90%.⁵¹ Back pain is common in competitive athletes, with an estimated prevalence ranging from 1% to 30%.^{4,49} The prevalence of LBP in recreational athletes is not known.²⁰ Many athletes do not report LBP and do not alter their activities. In professional sports, LBP is the most common cause of lost playing time.^{1,4}

The prevalence of spondylolysis in Alaskan athletes with Inuit background (high prevalence of spondylolysis) and African American athletes (lower incidence of spondylolysis) is

reflective of those populations. The opposite would be true in these 2 groups when the prevalence of LBP caused by sickle cell crises is examined.⁴⁶ Consequently, the evaluation of a 15-year-old gymnast with back pain of 1-week duration would differ greatly from that of a 55-year-old professional golfer with a history of prostate cancer.

Athletes in sports that require repeated hyperextension (eg, gymnastics, diving, volleyball) have a higher incidence of LBP.^{4,13} Some sport positions increase the likelihood of LBP, such as football offensive linemen and throwers (eg, baseball pitchers, football quarterbacks).⁴

HISTORY AND PHYSICAL EXAMINATION

The evaluation of athletes with LBP should focus on age-related problems (Table 1) and "red flags" in the history

Table 1. Common causes of low back pain by age.^{1,4,12,37,46}

Prepubescent	Adolescent	Adult	Elderly
Infection	Trauma	Discogenic	Osteoarthritis
Tumor or other malignancy	Spondylolysis	Mechanical back pain, unspecified	Spinal stenosis
Trauma	Hyperlordosis back pain	Osteoarthritis	Discogenic
Developmental	Discogenic		Medical cause

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Table 2. Important history questions and “red flags.”^{2,11,26}

History	Red Flags ^a
1. Why are you here today?	1. Pain made worse by rest, made better by activity
2. What is your pain level? a. Is the pain excruciating?	2. History of significant trauma, cancer, or weight loss
3. Age, sport, position, level of competition	3. History of conditions associated with osteoporosis a. Disordered eating b. Female triad c. Corticosteroid use d. Any condition that affects nutrition of the patient
4. What does the pain keep you from doing? a. Activities of daily living? b. Sport? c. Sleep?	4. History of any condition that would increase the risk of disc, bone, or viral infection a. Fever, chills b. Recent surgery c. Illegal drug use d. Alcoholism e. Immunosuppression (diabetes mellitus, HIV, etc)
5. When did it start? a. Hours? Days? Months?	5. Certain gynecologic conditions a. Is the patient pregnant? b. Endometriosis c. Pelvic inflammatory disease d. Symptoms worse with menses
6. Where does it hurt? a. Lumbosacral spine b. Leg(s) c. Hips d. Other	6. Certain gastrointestinal conditions a. Inflammatory bowel disease b. Symptoms of appendicitis or cholelithiasis c. Chronic diarrhea or heartburn
7. How did it happen? a. Mechanism b. Sudden onset or insidious c. Recurrent?	7. Certain neurologic conditions a. Cauda equine syndrome i. Saddle anesthesia ii. Bowel or bladder disturbance b. Brain tumor or stroke c. Progressive motor weakness d. Concurrent cervical spine pathology
8. Issues related to red flag symptoms	8. Certain urologic conditions a. Does the patient have a urinary tract infection? b. Does the patient have urethritis? c. Does the patient have prostatitis? d. Does the patient have a kidney stone?

^aHistory and physical findings that suggest a serious condition that needs immediate evaluation.

(Table 2). The sensitivity, specificity, and predictive value of tests and examination techniques used to evaluate LBP depend on the population being studied.^{1,2,11,12}

A recent Cochrane Review of physical examination techniques for LBP and radiculopathy found that the most useful tests were the straight leg raise and cross-table straight leg raise, especially when used together (Table 3).^{12,15} The

former is more sensitive and the latter more specific. The activity that reproduces the pain should be evaluated.^{13,48,53} Lumbar flexion stresses the anterior spine (disk, vertebrae, epiphysis), while lumbar extension stresses the posterior spine (facets, pars) (Table 4).

The athlete's ability to contract his or her abdominal and lumbar muscles is telling in the evaluation of athletes with

Table 3. Physical examination findings for neurologic causes of low back pain.^a

Test	Sensitivity, %	Specificity, %	Comments
Ipsilateral straight leg raising	0.80	0.40	Positive test result: leg pain at < 60°
Crossed straight leg raising	0.25	0.90	Positive test result: reproduction of contralateral pain
Ankle dorsiflexion weakness	0.35	0.70	HNP usually at L4-5 (80%) disk space (L5 nerve root)
Great toe extensor weakness	0.50	0.70	HNP usually at L5-S1 disk space (60%) or L4-5 disk space (30%)
Impaired ankle reflex	0.50	0.60	HNP usually at L5-S1 disk space (S1 nerve root); absent reflex increases specificity
Sensory loss	0.50	0.50	Area of loss is poor predictor of HNP level
Patella reflex	0.50	—	HNP at L3-4 disk space (L4 nerve root)

^aAdapted from Deyo et al.¹⁵ HNP, herniated nucleus pulposus.

Table 4. Causes of pain (flexion/extension).

Forward Flexion	Reverse Extension
<i>Consider:</i>	<i>Consider:</i>
Disc Epiphyseal injury Scheuermann disease Lumbar muscle sprain	Spondylosis Facet pathology (osteoarthritis) Hyperlordosis syndrome

LBP.^{22,23,25,34} Musculoskeletal ultrasound has been used to measure transverse abdominis and the lumbar multifidus muscle function in patients with LBP.^{10,24,33,34} This technique can also be used for biofeedback during lumbar stabilization while the athlete is being rehabilitated.^{24,33,50}

Prepubescent Athletes

The younger the child with LBP, the more likely a serious medical condition is the cause of the LBP (Figure 1).^{3,7,53} The time frame of the workup should be tempered by the physical examination and history. Patients unable to bear weight or those with fever, trauma, diabetes, or immunosuppression need immediate evaluation. Trauma is the most common cause of back pain, followed by musculoskeletal sprain, sickle cell crises, urinary tract infection, and renal and viral causes in children presenting to the emergency department.⁴⁶ A close

dermatologic evaluation (birthmarks, café au lait spots, buttock dimples, growths or hair tufts, shingles, folliculitis, abscesses, and contusions) is useful, as its markers are often associated with other nonmusculoskeletal pathology.¹ Deep tendon reflexes and lower extremity strength (heel and toe walking) should be checked for neurologic causes.

Children with painful scoliosis or pain at night deserve an immediate evaluation with radiographs (anteroposterior and standing lateral). Oblique views are not necessary in this age group, but the pelvis and hips should be included in the anteroposterior radiograph to rule out other pathology. A complete blood count, c-reactive protein, and a urinalysis are usually indicated.²⁹ A classification scheme of back pain in this age group includes several causes, such as mechanical, developmental, inflammatory, and neoplastic (Table 5).⁴²

Some forms of leukemia and lymphoma present with LBP or lower extremity discomfort.^{1,48} In addition to complete blood count and c-reactive protein, a lactate dehydrogenase level may help screen for tumors.¹⁸ Prompt relief of night pain and soreness with a moderate dose of nonsteroidal anti-inflammatory drugs suggests an osteoid osteoma or inflammatory pain from axial spondyloarthritis.^{44,50}

Inflammatory Conditions

Spondyloarthropathies typically begin in adolescence and affect the spine, hips, knees, and feet.^{6,36,44,50} There is a great deal of overlap among these various conditions that affect both the spine and the joints.^{6,14,44,50} Recent data in the rheumatologic literature allow earlier identification of these patients.^{6,14,44,50}

Effective medication can alter the disease course, making prompt diagnosis important (Figure 2).^{6,17,44} All patients under

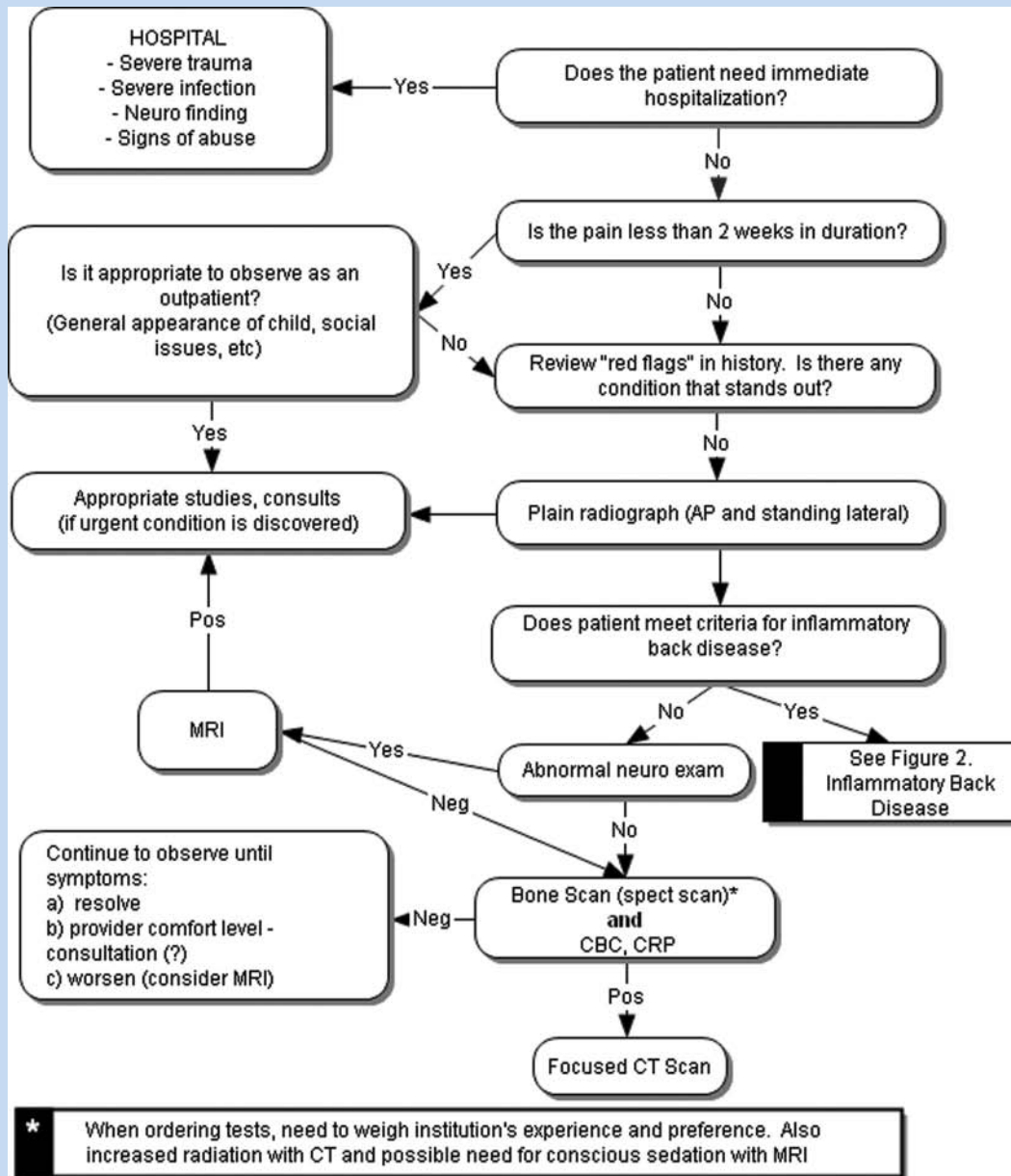


Figure 1. Back pain in children under 11 years of age.⁷

the age of 45 years with symptoms of more than 3 months should be asked 4 questions^{6,55}: (1) Does the morning back stiffness last over 30 minutes? (2) Does the back pain awaken you during the second half of the night? (3) Does the pain alternate from 1 buttock to the other? (4) Does rest relieve the pain? If 2 out of 4 questions are positive, there is a 70% sensitivity and 81% specificity for inflammatory back pain.⁶ If 3 of 4 questions are positive, the sensitivity drops to 33%, but the specificity approaches 100%.⁶ The history is much more accurate than laboratory testing in diagnosing these patients.⁶ C-reactive protein has only 53% sensitivity and

70% specificity in spondyloarthropathies (X20). HLA-B27 is not generally helpful in diagnosing spondyloarthropathies, because it has high positivity in the general population (Figure 2).^{5,21,35,36,39}

In spondyloarthritis, McRae's modification of the Schober test (Figure 3) and the chest expansion test are commonly positive (Figure 4).^{9,17} In addition, there may be tenderness over the sacroiliac joint. The sacroiliac joint should be evaluated for widening, erosion, sclerosis, and ankylosis.^{43,55} In young women, magnetic resonance imaging (MRI) of the sacroiliac joint will detect inflammation.⁵⁵ Computed tomography (CT)

Table 5. Common causes of back pain in children.⁴¹

Musculoskeletal	Infectious
Nonspecific musculoskeletal back pain Spondylolysis/spondylolisthesis Scoliosis Scheuermann disease Disc degeneration and/or prolapsed	Discitis Vertebral osteomyelitis, including tuberculosis (Pott disease) Epidural abscess Sacroiliac joint infection
<i>Other:</i>	<i>Nonspinal infection:</i>
Intervertebral disc calcification Congenital absence of pedicle Vertebral apophyseal fracture Aneurysmal bone cyst Sacroiliac joint stress reaction Idiopathic juvenile osteoporosis	Paraspinal muscle abscess Pyelonephritis Pneumonia Pelvic inflammatory disease Endocarditis Viral myalgias
Inflammatory	Neoplastic
Ankylosing spondylitis Psoriatic arthritis Inflammatory bowel disease–associated arthritis Reactive arthritis	Osteoid osteoma Leukemia or lymphoma Solid malignancy, primary or metastatic <i>Other benign tumor:</i> neurofibroma, vascular malformation
Other	
Appendicitis Sickle cell pain crisis Syringomyelia Cholecystitis Pancreatitis	Chronic recurrent multifocal osteomyelitis Psychosomatic illness Nephrolithiasis Ureteropelvic junction obstruction

scans are not recommended, because of the high gonadal radiation and inability to detect inflammation.^{30,55}

Patients who respond well to nonsteroidal anti-inflammatory drugs and have a negative HLA-B27 can be monitored.^{5,21} Those with a positive HLA-B27, those in question, and those who do not respond to therapy may benefit from further rheumatologic workup.

Athletes 13 to 55 Years Old

An athlete's emotional response, flexibility, and biomechanics may predict the risk of LBP.^{28,42} A prospective study of 679 college athletes with prior back injury showed that they were 3 times more likely to experience LBP compared with matched controls.¹⁹

The most common cause of LBP in the younger athletes is spondylolysis/spondylolisthesis, hyperlordosis syndrome, and discogenic back pain.³⁷ Adult athletes with LBP had a far greater risk of discogenic back pain (48%) than nonspecific mechanical back pain.

A number of conditions can adversely affect bone metabolism contributing to stress fractures or metabolic

bone pain. Steroids (asthma, allergies), the female triad (amenorrhea, osteopenia, disordered eating), hormonal issues (amenorrhea, thyroid irregularities, illicit use of hormones), infections, or chronic disease (inflammatory bowel, HIV) can affect bone health.^{13,54}

The physical examination should include deep tendon reflexes. Hyperreflexivity is associated with upper motor neuron pathology, prompting Babinski testing and evaluation of upper extremity deep tendon reflexes and strength.^{30,52} Poor reflexes may be normal in this age group; however, asymmetry could point to lower motor neuron injury or nerve root entrapment.^{52,54}

Palpation of the spinous processes and sacroiliac joint can help identify infection inflammation or fracture. Particular attention should be given to the triangle-shaped area between the dimples of venus and the anus (cysts, tufts of hair, dimples, or growth) as they are associated with congenital malformations such as tethered cord.^{52,54}

Teenagers may not complain of leg pain when disk pathology is present.⁴⁸ They may only have vague complaints with Valsalva maneuver or simply chronically tight hamstrings.⁴⁸ If pain does not improve over 2 to 3 weeks, radiographs should

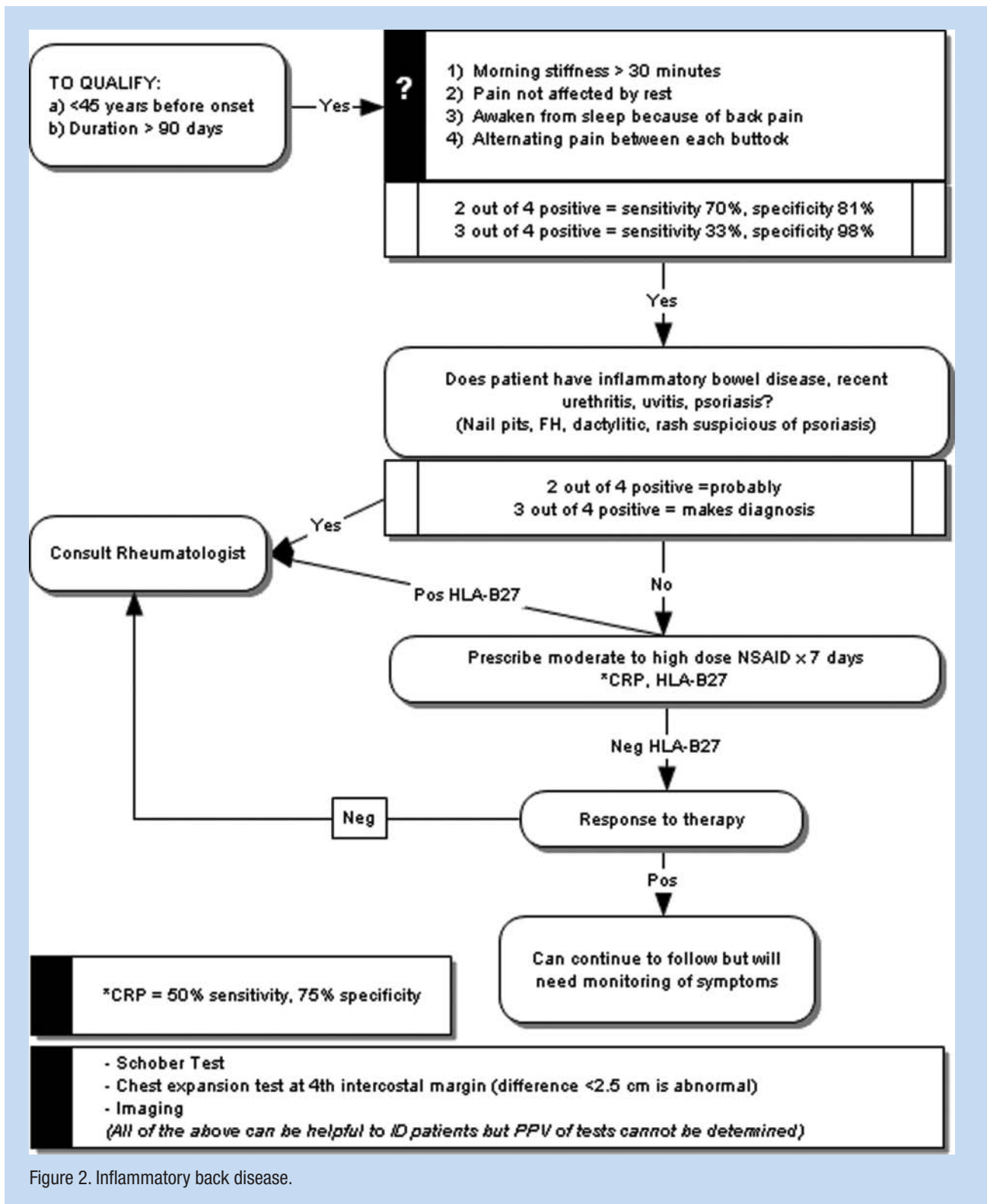


Figure 2. Inflammatory back disease.

be considered,^{4,13,53} including anteroposterior of the pelvis and hips and standing lateral view.^{4,13,53}

When anterior spinal pathology is suspected and disk, vertebrae, epiphysis, or abnormal neurologic findings are

present, an MRI is indicated.^{1,4} However, 1 in 5 MRIs will have a positive finding in the general asymptomatic population. Figure 5 outlines an approach to LBP in this population. MRI in athletes often poorly correlates with clinical outcomes.²⁷

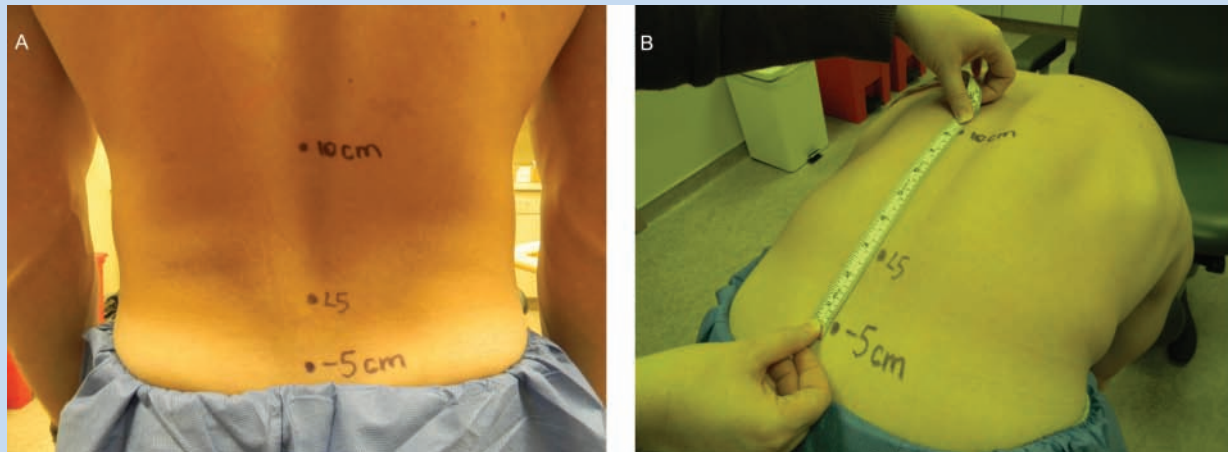


Figure 3. Modified Schober test (Macrae modification): A, with the patient standing upright, the spinous process of L5 is marked with a pen. A mark is made 10 cm above L5 and 5 cm below L5 in midline. B, the patient bends forward maximally, and the distance between the upper and lower marks is measured. Patients with normal mobility of the spine have an increase of at least 5 cm in the measured distance from upright (15 cm) to maximal flexion (should be > 20 cm).

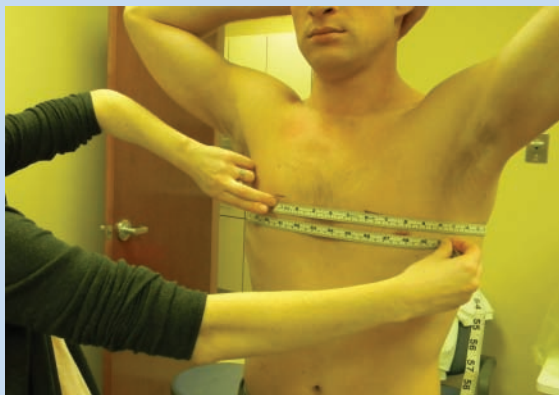


Figure 4. Chest expansion test. With the patient's hands elevated and folded behind the head, the chest is measured in circumference at the level of the fourth intercostal space, or just below the breasts in females. Chest circumference is measured after a maximal forced expiration and again after a maximal inspiration. Expansion should be > 5 cm. Expansion of < 2.5 cm is abnormal.

If pain is worse with extension with an otherwise normal neurologic examination, a SPECT (single-photon emission computed tomography) scan followed by focused CT scan may be indicated.^{13,48} In young patients, there is 53% probability that spondylosis is present.⁵³ The SPECT scan is much more sensitive than a standard bone scan.¹³ The limited CT scan greatly reduces the amount of radiation exposure.^{43,48} A positive or negative SPECT scan could influence return-to-play decisions for adolescent athletes.^{4,13}

An MRI may be preferred because of the lack of radiation and the ability to identify early bone edema, possibly before a

SPECT scan becomes positive.⁴³ Two-millimeter cuts through the posterior arch of the vertebrae with short tau inversion recovery or fat-saturated T2 signals are needed to attain the bone scan effect. T1 signals are needed to identify fractures.^{13,43} Patients with a history of spinal surgery may benefit from MRI with gadolinium to detect scar tissue after surgery that can impinge nerve roots.^{31,32}

Treatment

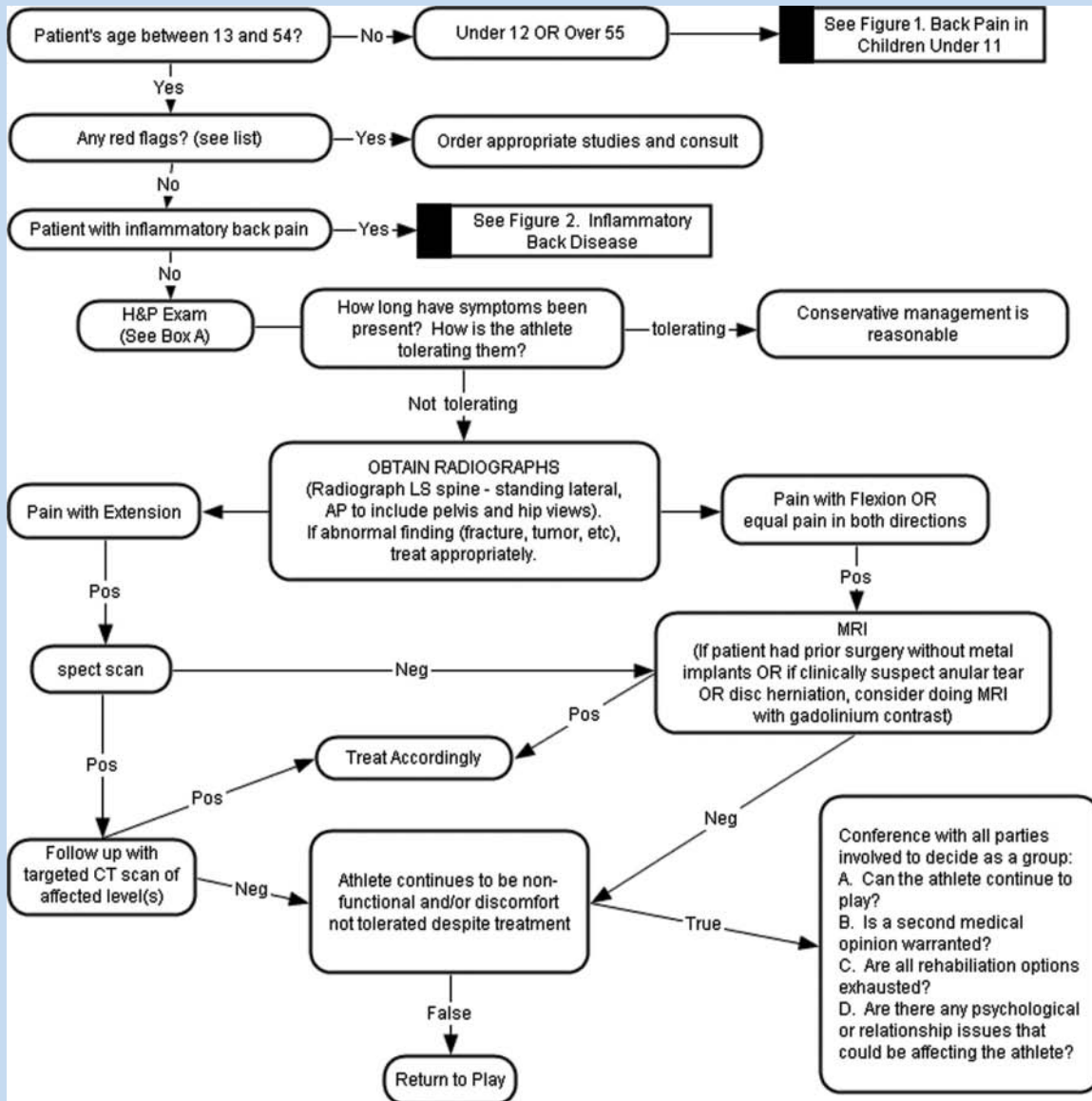
Most athletes with nonmetabolic LBP can be treated conservatively without surgery.^{13,48,53} The athlete must be monitored for increase or change of symptoms, motor weakness, and inability to urinate or saddle anesthesia. (Patients with LPB that present with these symptoms have a 95% chance of cauda equine syndrome.⁴) These symptoms should prompt further consultation.⁴ Psychosocial issues may affect the athlete's recovery.

Athletes Older Than 55 Years

These athletes are at greater risk of LBP from cancer, osteoarthritis, osteoporosis, and other nonmedical conditions.^{2,11,26,47} If the LBP persists for 2 weeks, plain radiographs should be considered.^{2,11,26,47} Laboratory testing may include serum protein electrophoresis (screening for multiple myeloma) along with alkaline phosphatase and prostate-specific antigen (Table 6).⁴⁰

CONCLUSION

By separating the athletes into preadolescent, adolescent, adult, and elderly age groups, an evidence-based, cost-effective evaluation can be performed. The focus of the evaluation should be on the history and physical examination. These will dictate the timing and need of imaging.



BOX A

A. Inspection

- Contusion
- Cafe au lait spots or other birthmarks
- Hair tuft between buttocks, dimple between buttocks

B. Palpation

- SI joint
- Spinous process

C. Neuro examination

1. SLR and XTSLR - Statistically significant to ID patients with nerve root entrapment from disc pathology
2. Long tract signs (to evaluate upper motor neuron pathology)
 - Hyperreflexive
 - Babinski
 - Hoffman


D. Evaluate most common nerve roots

S1	Walk on toes (planter flex)	Ankle	Outside foot
L5	Walk on heels (dorsiflex)	None	Inside foot
L4	Squat and rise (quads)	Knee	None
	Motor weakness	Reflexes	Sensory symptoms

Figure 5. Low back pain in the general asymptomatic population.

Table 6. Evaluation of elderly patient with back pain.⁴⁰

1	Elderly patients have much higher risk of more serious etiology for back pain than younger patients; most algorithms have been designed for younger patients who have lower incidence in osteoarthritis of the back and more medical problems
2	Bone scan should include whole body and not concentrate on just lumbosacral spine
3	Reasonable laboratory workup could include complete blood count, complete metabolic panel, sedimentation rate, urinalysis, thyroid-stimulating hormone, serum protein electrophoresis, bone scan negative with multiple myeloma, prostate-specific antigen
4	MRI should replace bone scan as second image after radiography of lumbosacral spine
5	Distinguish between neurogenic and vascular claudication
6	Higher risk of depression in this population
7	Disability questionnaires and screening tests for concurrent mental illness were designed for younger population and should be used with caution
8	Upper motor neuron disease increased risk in this population—Hoffman, Babinski positive
10	Reflex: evaluation much less accurate



SORT Recommendations

SORT: Strength of Recommendation Taxonomy
A: consistent, good-quality patient-oriented evidence
B: inconsistent or limited-quality patient-oriented evidence
C: consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
History and physical examination should guide treatment and evaluation of LBP in athletes. ^{1,4,11}	B
Physical examination techniques that are most useful include straight leg raise and cross-table straight leg raise. ^{12,15}	B
Routine imaging of nonspecific/mechanical back pain in athletes is not indicated. ¹¹	A

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