Back Pain in Adults

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KEYWORDS

• Back pain • Lumbar spine • Disk herniation • Imaging • Therapeutics
• Pharmacotherapy

KEY POINTS

- Back pain is common with most experiencing full relief of symptoms with minimal intervention within 4 to 6 weeks.
- The initial patient history and examination should focus on identifying any "red flags" that lead the clinician to suspect more severe pathology, such as cancer, infection, fracture, or cauda equina syndrome.
- For most patients, there is no indication for imaging of the lumbar spine and obtaining early studies does not improve outcomes.
- Radiographs are the initial imaging modality of choice, but rarely yield a definitive diagnosis.
- In nearly all complicated cases of back pain, MRI is the most useful imaging modality.
- NSAIDs are commonly used as a first-line therapy for back pain, but carry significant gastrointestinal, renal, and cardiovascular side effects.
- Despite their frequent use for more severe cases of back pain, there is only variable evidence regarding the effectiveness of opioids and systemic corticosteroids.
- Physical therapy is recommended when pain persists for more than 2 to 3 weeks. There is no standard protocol and the evidence supporting specific modalities is limited.
- Epidural steroid injections have been shown to provide a moderate short-term benefit for those with back and leg pain.
- Back surgery is indicated for the minority of patients, but provides the greatest benefit for those with sciatica, pseuoclaudication, or spondylolisthesis.

INTRODUCTION AND EPIDEMIOLOGY

Low back pain is a common problem accounting for a staggering use of the health care system with direct and indirect costs exceeding $100 billion per year in the United States.[1] To illustrate, low back pain is the second most common reason for a physician visit, it accounts for 2% to 3% of all physician visits, and 25% of all adults in the United States report at least 1 day of pain over a 3-month period.

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For most, this is a self-limited condition with 90% experiencing full relief of symptoms with minimal intervention.[2] However, nearly one-third experience pain in excess of 6 months[3] and one-fourth experience a recurrence within 1 year.[1] The prevalence of low back pain has been increasing since 1990 with patients more likely to seek care, require multiple visits, and report chronic pain. Those with chronic pain are more likely to become less physically active and report higher levels of disability.[4]

As in the general population, low back pain is common in athletes. Although overall prevalence is unknown, published rates in competitive athletes range from 1% to 30%.[5] In young and healthy populations, participation in sports seems to be a risk factor for back pain with athletes having a higher incidence compared with those who are sedentary. However, in former elite athletes, there seems to be a lower lifelong incidence.[5,6]

There are specific activities that carry a higher prevalence of low back pain, especially those that involve repetitive hyperextension, such as gymnastics, diving, volleyball, golf, or football (offensive line). Throwing athletes, such as quarterbacks and pitchers, also seem to be at higher risk for back issues. Most of these cases are self-limited and do not cause any alteration in activity. However, low back pain is the most common reason for lost time in a competitive athlete.[5,6]

HISTORY

Regardless of the level of activity of the patient, the history should focus on identifying any "red flags" for a severe pathology. Low back pain is such a common problem that an accurate history may be the only reliable way to determine if the patient's pain is from a benign cause rather than one necessitating rapid diagnosis and treatment. These causes include cancer, cauda equina syndrome, infection, and fracture. A patient's low back pain is not attributable to a spinal abnormality or disease state in 85% of cases so a rigorous work-up is not indicated unless there are clues in the history or physical examination. Even in the presence of a "red flag," only a minority of patients have significant pathology.[3,6–8]

The evaluation of all patients presenting with low back pain starts with a detailed history. At the minimum, it should include the onset, duration, location, and frequency of the pain. Attention should be paid to any clues of a neurologic deficit, radicular pain, spinal stenosis, or an inflammatory condition. Any history of a back injury, use of prior treatments, and their efficacy is also important to review. Perhaps more than in other conditions, a thorough psychosocial history should be taken with emphasis on substance abuse, injury litigation, workmen's compensation, job dissatisfaction, or psychiatric issues.

The history is crucial to finding any underlying "red flags" for more severe processes, such as cancer, vertebral fracture, cauda equina syndrome, or infection. The following should yield concern for neoplasm: any prior history of cancer or metastases; pain unrelieved by rest or when supine; systemic symptoms, such as fever, night sweats, or weight loss; advanced age (>50 years old); and greater than 6 weeks of pain. Those with a history of trauma, osteoporosis (or anything that affects bone health), substance abuse, long-term corticosteroid use, and the elderly are at higher risk for a vertebral fracture. Cauda equina syndrome should be considered if there are bowel or bladder symptoms; sudden onset of pain; or any progressive loss of neurologic function, such as loss of sensation or weakness. Spinal infection may present in the setting of prior lumbar surgery; unrelenting pain not relieved with rest; fever; immunosuppression; long-term corticosteroid use; intravenous drug use; or recent infection (eg, urinary tract, tuberculosis).

Other clues in the history may prompt further investigation for specific causes. The combination of back and leg pain, symptoms worse with sitting, the presence of

numbness or tingling are all typical of radicular pain from a herniated disk or sciatica. Spinal stenosis may present with leg pain that is in excess of back pain, pain exacerbated by standing or walking, or pain relieved by sitting or flexing the spine. Morning stiffness is the hallmark of an inflammatory condition. Patients may also present with constant pain, concomitant gastrointestinal or dermatologic problems, or the presence of other autoimmune diseases.

When treating athletes, it is crucial to obtain specific information regarding their sports or activities. Age, gender, and level of fitness are all useful pieces of information, but any changes in training patterns should also be noted. Review any changes in their training, such as technique, volume, or intensity. Also be sure to note how their symptoms have affected their ability to participate or their performance. The nature of their activity may also play a role in their pain if it involves hyperextension, throwing, twisting, or running. If the athlete has any condition that affects bone health, it places them at a unique risk for stress fractures. These include any aspects of the female athlete triad, deficiencies in calcium and vitamin D intake, any personal or family history of osteoporosis, or prior corticosteroid use.[6]

PHYSICAL EXAMINATION

Before a cause has been determined for low back pain, the physical examination should include at least the following elements:

- Inspection of the lumbar spine
  - Assess for kyphosis, lordosis, or scoliosis
  - Rashes, wounds, signs of trauma or infection
  - Hair patches, sacral dimple, nevi, cafe au lait spots
- Range of motion
  - Lumbar flexion stresses the anterior spine (disk, vertebrae)
  - Lumbar extension stresses the posterior spine (pars, facets)
- Gait evaluation
  - Limping
  - Foot drop
  - Tandem gait
  - Trendelenburg gait
- Palpation of the spine and paraspinal areas
- Straight leg raise testing for those with leg pain[9]
  - Done with the patient supine, examiner passively raises the leg
  - Recreates radicular pain between 10 and 60 degrees
  - When present, a sensitive, but not specific sign
  - Crossed straight leg raising (testing the unaffected leg) carries a higher sensitivity
- Lower extremity neurovascular examination
  - Strength, sensation, and reflex testing (**Table 1**)
  - Focus on L4-S1 nerve roots because this accounts for nearly all disk pathology[3,9]
  - Diminished reflexes may be normal with advanced age
  - Spinal stenosis may have a similar presentation as vascular disease

Significant vertebral tenderness, limited range of motion, fever, or open wounds may be indicative of infection. Fractures also present with limited range of motion and marked vertebral tenderness. Progressive neurologic deficits, such as marked weakness, sensory deficits, loss of anal sphincter tone, or saddle anesthesia, yield a concern for cauda equina syndrome. Lymphadenopathy or other abnormal physical

Table 1
Correlation of physical examination findings with corresponding nerve roots

Nerve Root	Reflex	Strength	Sensory
L4 (L3-L4 disk space)	Patella	Ankle dorsiflexion (tibialis anterior); heel walk	Medial side of the lower leg (medial malleolus)
L5 (L4-L5 disk space)	None	Dorsiflexion of the great toe (extensor hallucis longus)	Lateral aspect of the lower leg and dorsum of the foot
S1 (L5-S1 disk space)	Achilles	Plantar flexion and eversion (peroneus longus and brevis); toe walk (gastrocnemius)	Lateral and plantar side of the foot; lateral malleolus

examination findings related to potential sites of cancer may be present with neoplasm or malignancy.[6,7,9,10]

IMAGING

For most patients with low back pain, imaging is not warranted and does not improve outcomes.[3,7,11] During the first 4 to 6 weeks of symptoms, the American College of Physicians advises that imaging be delayed unless there are signs or symptoms of a serious underlying "red flag" condition. They, along with the American College of Radiology, have developed criteria for early imaging (**Table 2**).

When imaging the lumbar spine, radiographs are generally the initial test of choice. Although they typically do not provide definitive diagnosis, they can be useful to rule out fractures in the setting of "minor" red flags, such as low-velocity trauma or advanced age. Radiographs may also reveal signs of osteoporosis. For most, magnetic resonance imaging (MRI) is the test of choice for complicated low back conditions. These include pain for greater than 4 to 6 weeks, the presence of any historical "red flags," concern for spinal stenosis, radicular symptoms, or neurologic findings. MRI has the advantage of provide details of the bony anatomy and the soft tissues.[3,10]

Table 2
Indications for early imaging of the lumbar spine

American College of Physicians Practice Guideline: Indications for Early Imaging in Low Back Pain	American College of Radiology Appropriateness Criteria for Imaging
Progressive neurologic findings	Symptoms >6 wk
Constitutional symptoms	Trauma
Age >50 y old	Age >70 y old (or trauma at >50 y old)
Trauma	Weight loss
History of malignancy	Fever (unexplained)
Osteoporosis	Cancer
Risk factors for infection (steroid use, immunosuppression, intravenous drug use)	Long-term steroid use or osteoporosis Intravenous drug use Immunosuppression Progressive neurologic deficit Disabling symptoms Prior surgery

Data from Chou R, Qaseem A, Owens DK, et al. Diagnostic imaging for low back pain: Advice for high-value health care from the American College of Physicians. Ann Intern Med 2011;154:181–9; and American College of Radiology. ACR Appropriateness Criteria. Low back pain. http://www.acr.org/~/media/ACR/Documents/AppCriteria/Diagnostic/LowBackPain.pdf. Accessed July 9, 2012.

Computerized tomography (CT) is useful for patients who cannot undergo MRI, those with surgical hardware, or if there is a need for precise bony anatomy. Myelography, diskography, and bone scan are reserved for when specific conditions are suspected. Bone scan with single photon emission CT (SPECT) imaging provides the sensitivity of a bone scan along with three-dimensional resolution. This makes SPECT a particularly attractive option for the diagnosis of stress fracture. Unlike traditional bone scan, SPECT scans take images from multiple angles and the data can be manipulated to display the anatomy in thin slices much like CT or MRI. Fire scan is an emerging technology that digitally combines CT in tandem to bone scan with SPECT images. It has the unique ability to provide sensitivity of bone scan with bony detail of CT scan. It is purported to have a unique ability to identify areas of bone turnover in great detail, particularly in facet disease.[12]

Athletes carry a higher suspicion of stress fracture than the general population. In light of that, bone scan with SPECT imaging is frequently used early in the evaluation of back in athletes. However, even in those cases where there is high suspicion for bony abnormality, it has been recommended that MRI remain the preferred modality. MRI identifies the subtle changes of bony injury while also providing further detail regarding other structures, such as intervertebral disks. Further modalities could then be used if the diagnosis remains in question.[13]

DIFFERENTIAL DIAGNOSIS

Tables 3–9 illustrate the differential diagnosis.[3,6,10,14–18]

Table 3
Common causes of low back pain

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Lumbar strain	• Acute onset, possibly an injury • Symptoms worse with activity, relieved with rest • Paraspinal spasm or tenderness	• Only to exclude alternative diagnoses
Disk herniation	• Pain often worse with sitting • Symptoms radiate to lower extremities, typically below the knees • Follows dermatomal pattern • Positive straight leg raise	• MRI if symptoms >4 wk • Electromyography and nerve conduction studies if diagnosis in question
Degenerative disk disease	• Pain worse with flexion or sitting • Chronic pain	• Radiographs • MRI
Facet disease	• Pain worse with extension • Worse with standing or walking	• Radiographs • MRI
Spondylolisthesis	• Leg pain may be greater than back pain • Worse with extension, relieved by flexion • Pain worse with activity	• Radiographs • MRI
Spinal stenosis	• Pain relived by sitting or flexion • Lower-extremity paresthesias, possibly bilateral • Neurogenic claudication (pseudoclaudication) • Elderly	• MRI • CT may be useful to delineate bony anatomy • Vascular studies to rule out claudication

Table 4
Causes of low back pain warranting emergent treatment

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Neoplastic: • Myeloma • Spinal cord tumor • Metastases	• Systemic symptoms: fever, weight loss, fatigue • Pain when lying down or night pain • History of cancer	• Radiographs • MRI
Cauda equina syndrome	• Saddle anesthesia • Progressive motor or sensory changes • Urinary retention • Bowel or bladder incontinence • Loss of rectal tone	• MRI
Infection • Osteomyelitis • Diskitis • Epidural abscess	• Fever • Loss of range of motion • History of intravenous drug abuse • Severe pain • Recent surgery or infection • Immunosuppression	• MRI • Complete blood count • Blood culture • Sedimentation rate • C-reactive protein
Fracture	• History of trauma • Low bone mineral density/osteoporosis • Corticosteroid use • Vertebral tenderness • Elderly	• Radiographs • Additional imaging if diagnosis in question

Table 5
Inflammatory causes of low back pain

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Ankylosing spondylitis	• Younger population • Predominantly males • Morning stiffness • Pain relieved by activity • Night pain	• Radiographs • Sedimentation rate • C-reactive protein • HLA-B27
Reactive arthritis	• Aseptic arthritis triggered by an extra-articular infection • History of recent gastrointestinal or genitourinary infection • Lower extremities most commonly involved • Classic triad: uveitis, arthritis, urethritis	• Sedimentation rate • C-reactive protein • HLA-B27 (30%–50%) • Imaging to exclude alternative diagnosis
Psoriatic arthritis	• Asymmetric and distal joint involvement • Frequent sacroiliac joint involvement • History of psoriasis with skin and nail changes	• Radiographs
Inflammatory bowel disease	• Systemic manifestation of inflammatory bowel disease • Does not have to correlate with inflammatory bowel disease flare	• Used to exclude alternative explanation for pain
Transverse myelitis	• Develops over 24 h • Typically thoracic spine involvement • Symptoms usually bilateral and occur below level of the lesion • Presents with weakness and sensory deficits or paralysis	• MRI • Cerebrospinal fluid analysis

Table 6
Vascular causes of low back pain

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Spinal cord vascular malformation	• Men > women • Typically >50 y old • Progressive radicular symptoms • Psuedoclaudication as in spinal stenosis	• MRI with angiography
Spinal cord infarction	• Rapid onset, often in setting of hypotension or aortic pathology • Pain caused by ischemia • Neurologic deficit ranges from weakness to paresis • Correlates with level of impairment (most common is T8) • History of vascular disorder (eg, vascu litis, hypercoagulable state) • History of diabetes mellitus	• MRI (may be normal for up to 24 h)
Epidural hematoma	• Most often a complication of a procedure (epidural injection or surgery) • Rarely spontaneous • Back or radicular symptoms • Progresses to motor and sensory deficits, possible bowel or bladder involvement	• MRI

Table 7
Metabolic causes of low back pain

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Paget disease	• Aching pain that persists into the night • Bony changes and overgrowth lead to pain and spinal stenosis • Cord compression may lead to ischemia	• Radiographs • Alkaline phosphatase • Tests for increased bone turnover • MRI to exclude alternative cause for symptoms
Osteoporosis	• Any comorbidity affecting bone health • History of low bone mineral density • Family history of osteoporosis	• Imaging to rule out fractures • Bone density (DEXA) scan

Table 8
Miscellaneous causes of low back pain

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Episacroiliac lipoma ("back mouse")	• Low back pain described as moving to different locations • Rubbery, mobile mass deep subcutaneous tissue	• Done to rule out alternative diagnoses
Zoster	• Vesicular rash • Dermatomal pattern	• Confirmation with polymerase chain reaction testing or culture
Lyme disease (or other tick-borne illness)	• History of tick bite • Travel to endemic area • Characteristic rash ("target lesion")	• EIA Western blot
Statin-induced myopathy	• Use of statin medications	• Elevated creatinine kinase level

Table 9
Extraspinal causes of low back pain

Diagnosis	Key Historical and Physical Examination Findings	Diagnostic Studies
Aortic dissection or aneurysm	• Pulsatile abdominal mass • Hypertension (or hypotension if ruptured)	• Radiographs may reveal abnormality, but CT scan diagnostic
Kidney stone	• History of stones • Hematuria • Pain radiates to groin	• Red blood cells in urine • Radiographs or CT scan
Pyelonephritis	• Fever, systemic symptoms • Costovertebral angle tenderness	• White blood cells or casts in urine
Retroperitoneal hematoma or abscess	• Recent trauma • Anticoagulant use • Fever, immune deficiency • Retroperitoneal tenderness	• CT scan or ultrasound
Psoas abscess	• Psoas sign • Fever, immune deficiency	• CT scan or ultrasound
Splenic rupture or infarct	• Trauma • Viral infection (mononucleosis) • Hemoglobinopathy	• CT scan or ultrasound
Sickle cell crisis	• History of sickle cell disease (or trait)	

TREATMENT OPTIONS

Most acute episodes of low back pain resolve with conservative therapy within 4 to 6 weeks. However, 5% to 10% of patients develop chronic symptoms (pain lasting greater than 3 months) for which a uniformly effective treatment regimen is lacking. Decisions are complicated by lack of high-quality randomized controlled trials. The goals of treatment should be to educate patients, decrease pain, improve function, and minimize side effects associated with chosen treatment modalities.

Medications

There are a variety of different classes of medications that can be used in the management of low back pain. A main goal of therapy is to use the lowest effective dose for the shortest period of time necessary.

Nonsteroidal anti-inflammatory drugs

Various nonsteroidal anti-inflammatory drugs (NSAIDs) are used in back pain.[3,10,19–26] A recent large Cochrane review[24] supported the use of NSAIDs as first-line management in the treatment of acute and chronic low back pain without sciatica. This review included 65 randomized controlled studies and found statistically significant results in favor of NSAIDs over placebo for improved functional status, number of patients recovered, and decrease in pain intensity from baseline. The 2008 Cochrane review also examined the effectiveness of NSAIDs and found moderate evidence that NSAIDs are equally effective as paracetamol/acetaminophen for pain relief and global improvement.

A higher rate of side effects with all NSAIDs is noted when compared with acetaminophen/paracetamol. This is true for nonselective NSAIDs and the cyclooxygenase-2

(COX-2) selective drugs. The Cochrane review from 2008 concluded that NSAIDs were associated with an increased risk of side effects compared with paracetamol with a relative risk of 1.76 (95% confidence interval, 1.12–2.76; N = 309).

Nephrotoxicity is a concern with all NSAIDs, especially in the elderly and those with underlying renovascular disease. Gastrointestinal adverse events including dyspepsia, ulcer disease, and bleeding are also known side effects. In select populations including those with a history of NSAID-induced peptic ulcer disease, coadministration of a proton pump inhibitor with an NSAID had similar efficacy when compared with COX-2 therapy in terms of arthritic pain control and had less dyspepsia than the COX-2 treatment group (15% vs 5.7%).[25]

The risk of adverse cardiovascular events varies with the NSAIDs. Rofecoxib, a COX-2, was removed from the market because of increased cardiovascular events. A meta-analysis published in 2006[26] found an increase in vascular events in not only the COX-2 medications but also the nonselective NSAIDs, specifically ibuprofen and diclofenac. A 42% relative increase in vascular events compared with placebo was found with use of COX-2 inhibitors. Traditional NSAIDs had a vascular event rate similar to COX-2 medications. Of note, naproxen seemed to have less of a risk of vascular events in this meta-analysis compared with placebo and ibuprofen and diclofenac. Caution is advised when prescribing all NSAIDs especially to those with underlying cardiovascular disease or risk factors for cardiovascular disease.

If a patient does not respond to one NSAID it is worthwhile to try another NSAID of a different class before abandoning NSAIDs as a potential treatment option.

Acetaminophen

Acetaminophen is effective for pain relief and is an option for first-line management of low back pain. It is associated with fewer side effects when compared with NSAIDs. The main concern associated with its use is hepatotoxicity especially in patients with underlying liver disease or alcohol use. Asymptomatic elevations in aminotransferase levels can also occur even in healthy patients especially in doses greater than 4 g per day.[3,10,19–24]

Tramadol

Tramadol acts as a weak opioid receptor agonist and inhibits the reuptake of serotonin and norepinephrine. A 2007 Cochrane review found tramadol to be more effective than placebo for pain control in low back pain. Other studies have demonstrated short-term improvements in pain and function but no long-term studies exist. Most common side effects are headache and nausea. Use with caution in patients with a history of narcotic addiction because of its action at the opioid receptor.[3,10,19–23,27]

Opioids

Too few high-quality studies exist with regards to efficacy of opioids in the management of low back pain. Therefore, use is based on clinical judgment. They are typically not considered a first-line management option. In this author's opinion opioids may be considered a treatment option in patients with severe pain that is not effectively controlled by NSAIDs, acetaminophen, or other conservative management options. Pain that interferes with sleep may also warrant consideration for opioid use. Side effects include nausea, constipation, sedation, confusion, addiction, and dependence.[10,21,27–29]

Systemic corticosteroids

These are not recommended for treatment of isolated low back pain because of lack of evidence showing efficacy.[10,20] There is variable evidence regarding use in acute low

back pain with radicular symptoms, but they may be of benefit.[3,22] Patients should be educated about potential adverse effects when these medications are used including agitation, irritability, insomnia, and poor glycemic control in those with diabetes mellitus.

Topical analgesics

These agents provide the advantage of avoiding systemic toxicities, but have the limitation of providing treatment to a localized area. Side effects include skin irritation or allergic reaction. Topical analgesics can be used alone or in conjunction with other therapies including oral medications.[30–33]

Capsaicin, a derivative of cayenne peppers, has shown positive but weak evidence in the treatment of neuropathic and musculoskeletal pain.[30,31] Its proposed mechanism of action is depletion of substance P from the sensory afferent nerve fibers. It must be applied multiple times a day for several weeks to get the full benefit. Topical capsaicin is well tolerated by most, but some experience an intolerable burning sensation. A 2006 Cochrane review[31] reported improvement on the visual analog scale at Days 3 and 14 with regards to acute low back pain and treatment with a topical cream containing capsicum. Similar findings were found for chronic low back pain using a capsicum-containing plaster.

Lidocaine 5% patch is another topical option, but there is no documented evidence regarding effectiveness for the treatment of acute or chronic low back pain. The Food and Drug Administration (FDA) has approved it for the treatment of the pain associated with postherpetic neuralgia. It has also shown potential use for myofascial pain[32,33]; however, more studies are needed. Lidocaine patches are generally well tolerated.

Muscle relaxants

These are effective for short-term symptomatic relief of low back pain especially when combined with NSAID therapy. There is mixed evidence to support long-term use in chronic low back pain. There is a high rate of side effects including dizziness and sedation.[3,21,29,34]

Antidepressants

Conflicting conclusions exist regarding the efficacy of antidepressants in the treatment of chronic low back pain and they should not be considered first-line therapy. A 2003 systemic review of seven randomized controlled trials[35] concluded that tricyclic antidepressants but not selective serotonin reuptake inhibitors provided moderate symptom reduction for patients with chronic low back pain. However, a 2008 Cochrane review[36] stated antidepressants were no more effective than placebo in the treatment of chronic low back pain.

Amitriptyline, a tricyclic antidepressant, is useful in patients with neurogenic pain. Its role in the treatment of back pain is not well defined, but its sedative qualities make it a good option for nighttime use in patients with sleep disturbances.[10,21,35–37]

Depression screening is recommended in patients with chronic low back pain because these two conditions frequently coexist. In 2010, duloxetine was FDA approved for the treatment of chronic musculoskeletal pain including low back pain.[38]

Herbal therapy

Long-term safety data do not exist but short-term studies show herbal preparations, such as devil's claw, white willow bark, and cayenne, may have a role in the treatment of chronic low back pain.[31]

Others

Anticonvulsants including gabapentin are sometimes used for chronic low back pain complicated by radiculopathy and show possible benefits in some trials. At this time, this is not an FDA-approved indication.[39]

Benzodiazepines are commonly used for muscle relaxation in severe cases. This class of drugs can be associated with abuse, addiction, and tolerance. Therefore, they should be used cautiously.[3,10,21,29,40]

Bed Rest

Activity modification is advocated for the treatment of acute low back pain rather than bed rest and immobilization. Bed rest may be recommended for 1 to 2 days if there is severe pain, but patients should be educated that longer periods of bed rest can be associated with a delayed recovery, joint stiffness, and muscle wasting. Provide patient reassurance and education that it is safe to get out of bed and perform activities as tolerated.[3,19,22,41,42]

Physical Therapy

Referral for a course of physical therapy is typically recommended if symptoms persist for more than 2 to 3 weeks. No standard protocol exists. The variety of interventions and modalities used make comparing studies difficult. Individualized regimens that include therapist supervision, stretching, and strengthening tend to be associated with the best outcomes. The McKenzie method, spine stabilization exercises, and home exercise program all display benefits. Traction therapy is "probably not effective" as a single treatment for low back pain according to the 2010 Cochrane review.[3,10,20,22,29,43]

Topical Cold Versus Heat Therapy

Heat therapy seems to be beneficial in reducing pain associated with acute low back pain. Additional pain relief and improved function are achieved when combined with exercise. Minimal evidence exists for the use of cold therapy in acute low back pain.[3,10,29,44,45]

Transcutaneous Electrical Nerve Stimulation

Based on a 2010 review, current evidence does not support the use of transcutaneous electrical nerve stimulation unit in the management of chronic low back pain. As of 2012, Medicare no longer provides coverage for a transcutaneous electrical nerve stimulation unit for this purpose.[10,46,47]

Lumbar Corsets

Evidence for efficacy is unclear regarding use of lumbar corsets in the management of acute and chronic low back pain. Studies show a possible benefit if a lumbar corset is combined with additional spinal support, such as a heat-moldable plastic insert.[3,10,48]

Injection Therapy

The rates of epidural steroid injections and facet injections rose 271% and 231%, respectively, between 1994 and 2001 in the Medicare population.[49]

Epidural steroid injections

Numerous studies have failed to yield a definitive answer regarding the efficacy of epidural steroid injections with published ranges of efficacy between 18% and

90%.[21,22,49–53] The wide range of published efficacy reflects the lack of standardization in injection technique, patient heterogeneity, and the differences in the methodology of the studies analyzing the data. Moderate short-term benefit in patients with chronic low back pain with radiculopathy has been shown.[50] Injections should always be used in conjunction with a multidisciplinary treatment plan.

In a recent study of National Football League players,[52] epidural steroid injections were found to be safe and effective in the treatment of symptomatic acute lumbar disk herniations and allowed a quick return to play. Loss of practice and game time is of high concern in all athletes but especially so in the professional athlete. Therefore, interventions that provide a more rapid return to play are always being sought. In this study, 17 players who had 27 acute disk herniations that were confirmed on MRI from 2003 to 2010 underwent epidural steroid injections. The outcomes were promising because the success rate for returning the athletes to play was 89% with an average loss of 2.8 practices (range, 0–12). Only three players failed conservative treatment and went on to surgery. Risk factors for failed conservative management in this study were disk sequestration noted on MRI and weakness on physical examination. In patients without radicular symptoms no benefit with epidural steroid injections has been shown.

Facet injections and medial branch nerve blocks

Conflicting evidence exists for the efficacy of intra-articular corticosteroid facet injections and medial branch nerve blocks on short- and long-term pain control for facet-related back pain. However, they may be of benefit.[10,22,51,54,55]

Prolotherapy

Prolotherapy is an injection therapy that is thought to aide in the healing of chronic degenerative soft tissue conditions potentially by triggering an acute inflammatory response.[22,56–58] A variety of injected solutions including dextrose, sodium morrhuate, and phenol have been used. No standardized protocol exists.

A Cochrane review[58] published in 2007 found that prolotherapy alone is not effective in the treatment of chronic low back pain. However, when combined with other interventions it may be of benefit. More studies are needed.

Complementary and Alternative Medicine

This broad group of therapies is a popular addition to traditional medical management for acute and chronic low back pain.[19,20,22,59,60] A total of 45% of individuals with back pain see a chiropractor, 24% use massage therapy, and 11% receive acupuncture. Most patients often fail to disclose use of these treatment options to their health care provider.

More high-quality studies are needed to further elucidate the evidence for these treatment options when used alone or in combination with standard medical treatment. Various modalities exist including acupuncture, mobilization/manipulation, and massage that seem to show promise in the treatment of select individuals with acute and chronic low back pain. The safety profile for most complementary and alternative therapies is acceptable.

Stem Cell Therapy

Autologous mesenchymal stem cell therapy for chronic low back pain caused by degenerative disk disease has shown benefit in animal studies and is now being examined as a treatment option in humans.[61] In a pilot study published in 2011, 10 patients with degenerative disk disease with a preserved external annulus fibrosis who had failed conservative therapy (physical and medical options) underwent mesenchymal

stem cell and showed statistically significant improvements in lumbar pain levels and level of disability. Although more research is needed, stem cell therapy is another nonsurgical option on the horizon in the treatment of chronic low back pain.

SPECIAL CONSIDERATIONS FOR ATHLETES

Back pain is the most common reason for time away from sports.[5,6,13,20,22,42] Rates vary among sports and data regarding prevalence compared with the general population are inconsistent. Combined with the lack of high-quality randomized studies, it is difficult to make general recommendations. Nonetheless, some inferences can be made:

- Treatment algorithms for athletes should be similar to the general population.
- Relative rest or time off from sports may be appropriate, but there is no role for bed rest in the treatment of low back pain.
- Earlier imaging does not improve outcomes. Radiographs rarely provide definitive diagnosis. Despite a higher rate of stress fracture than the general population, MRI remains the advanced imaging modality of choice for most athletes.
- Injury-specific and postsurgical return to play guidelines lack standardization.
- Despite the variability in protocols and lack of high-quality data, physical therapy or an exercise program that focuses on spine stabilization and core strengthening are programs with encouraging outcomes.

REFERRAL AND SURGICAL INDICATIONS

Back surgery is indicated for only a minority of patients with low back pain.[10,19,21,62–70] However, the rates of low back surgery in the United Sates are increasing. Patients with persistent pain, despite conservative management or progressive neurologic deficits, should be referred for a surgical evaluation especially in cases of herniated disk, spinal stenosis, and spondylolisthesis. The National Institutes of Health–supported Spine Patient Outcomes Research Trial (SPORT) was designed to evaluate the surgical and nonsurgical treatment of intervertebral disk herniations, degenerative spondylolisthesis, and lumbar spinal stenosis. The SPORT studies were randomized, prospective, multicenter trials that included an observational cohort arm.

Intervertebral Disk Herniation

SPORT participants had to meet strict inclusion criteria, which included symptoms for at least 6 weeks, imaging that supported clinical findings, and neurologic signs.[62–65] The surgical procedure was open discectomy.

Nonsurgical and surgical groups showed improvement. In the intent-to-treat analysis all measures favored surgery; however, this difference was not statistically significant regarding the primary outcome measures (self-reported improvements in impairment and health-related quality of life) but was statistically significant for secondary outcome measures (patient satisfaction, self-rated progress, and improvements in sciatica symptoms). When the randomized group and the cohort group are analyzed together, the as-treated analysis shows a statistically significant improvement in all measured outcomes for the surgery group compared with the nonsurgical patients. Improvements after surgery were maintained at greater than 4 years follow-up. Characteristics that increased the treatment effect of surgery were being married, absence of joint problems, and worsening symptoms from baseline.

Degenerative Spondylolisthesis

The surgical procedure was a posterior laminectomy with or without bilateral single level fusion with or without instrumentation.[66] Inclusion criteria included symptoms for at least 12 weeks and imaging confirmation of degenerative spondylolisthesis.

In a combined as-treated analysis of the randomized group and the cohort group, surgery was favored and demonstrated statistically significant improvements in all primary and secondary outcome measures including pain, improvements in disability and function, and patient satisfaction.

Lumbar Spinal Stenosis

The surgical procedure was a posterior decompressive laminectomy.[63,67,68] All patients had symptoms for at least 12 weeks, had neurogenic claudication or radicular leg symptoms, and imaging showing lumbar spinal stenosis at one or more levels.

Similar to the findings with disk herniation and spondylolisthesis, when a combined analysis is done including the randomized and cohort groups, surgery for symptomatic lumbar spinal fusion was favored in all primary and secondary outcome measures including improvements in pain and function and patient satisfaction when compared with nonsurgical treatment. The improvements were also maintained at the 4-year follow-up.

A systemic review[68] published in 2003 also showed surgery was more effective than continued conservative treatments for patients with symptomatic lumbar spinal stenosis who had underwent at least 3 to 6 months of conservative management. The improvements were seen in pain, function, and quality of life, but not walking ability.

Disk Replacement and Spinal Fusion

Disk degeneration is a common part of the aging process and frequently deemed to be the source of nonspecific chronic low back pain. After patients have failed a trial of conservative management, they are referred to surgery to remove the degenerative disk.

Traditional surgical procedures involve removing the disk and doing a fusion of the inferior and superior vertebrae. New techniques involve disk replacement with a plastic or metal artificial implant.

A recent Cochrane review[69] examined seven randomized controlled trials. Six of the trials compared disk replacement with spinal fusion and one compared disk replacement with nonsurgical treatment. The conclusion of the Cochrane review was that based on the short-term studies that are available, disk replacement is at least equivalent but not superior when compared with fusion with respect to pain control, disability levels, and improved quality of life. In patients with nonspecific chronic low back pain who have failed adequate trials of at least 2 years of nonsurgical interventions, surgery can be considered an option.[70]

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