

In the Clinic®

Low Back Pain

Low back pain is a common problem that is the leading cause of disability and is associated with high costs. Evaluation focuses on identification of risk factors indicating a serious underlying condition and increased risk for persistent disabling symptoms in order to guide selective use of diagnostic testing (including imaging) and treatments. Nonpharmacologic therapies, including exercise and psychosocial management, are preferred for most patients with low back pain and may be supplemented with adjunctive drug therapies. Surgery and interventional procedures are options in a minority of patients who do not respond to standard treatments.

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Physician Writer
Roger Chou, MD
Oregon Health & Science
University, Portland, Oregon

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Prevention

Diagnosis

Treatment

Practice Improvement

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Prevention

The lifetime prevalence of low back pain is nearly 80%, and spinal disorders are the fourth most common primary diagnosis in U.S. office visits (1, 2). Globally, low back pain is the leading cause of years lived with disability and accounts for greater health care expenditures than any other condition (3, 4). In most patients, a specific cause cannot be identified, and episodes usually

improve within days to a few weeks with self-care (2, 5). However, the proportion of patients with persistent back pain or activity limitations is higher than previously realized (6). Because low back pain is common and can become chronic or lead to disability, it is important that physicians be proficient in its evaluation and management.

What factors are associated with low back pain?

Factors associated with low back pain include obesity, physical inactivity, occupational or lifestyle factors, and depression and other psychosocial factors (see the **Box: Factors Associated With Low Back Pain or Disability Claims for Low Back Pain**). Strategies such as maintenance of normal body weight, physical fitness, and proper posture and lifting techniques might decrease risk, but direct evidence documenting the value of such interventions is lacking.

Clinicians should remember that back pain (the symptom), a health care visit for back pain, and work loss or disability due to back pain do not necessarily reflect the same underlying construct. Symptom severity does not correlate well with health care seeking or functional outcomes.

Should clinicians advise patients about preventing low back pain?

In 2005, the U.S. Preventive Services Task Force concluded that the evidence was insufficient to recommend for or against routine use of interventions in primary care settings to prevent low back pain in healthy adults (7).

However, the Task Force noted that regular physical activity has other proven health benefits. Subsequent systematic reviews found that exercise programs after an acute low back pain episode (alone or in combination with education) can reduce recurrences (8, 9).

Are specific measures effective in preventing low back pain at work?

People whose jobs require heavy lifting and other physical work may be at risk for low back pain. Low back pain is a common cause of lost workdays and receipt of workers' compensation. Approaches to preventing back pain in the workplace include educational interventions and mechanical supports, but studies have generally not shown benefits.

A systematic review of 9 randomized controlled trials (RCTs) and 9 cohort studies found no evidence that advice or training on correct lifting techniques was effective in preventing low back pain (10). Another systematic review found that external back supports, such as a back brace or belt, were not effective for preventing back pain (11).

Factors Associated With Low Back Pain or Disability Claims for Low Back Pain

Work that involves heavy lifting, bending and twisting, or whole-body vibration, such as truck driving
Physical inactivity
Obesity
Arthritis or osteoporosis
Pregnancy
Age >30 years
Bad posture
Stress or depression
Smoking

Prevention... Regular exercise and maintenance of fitness, with or without educational interventions, may be helpful in preventing recurrent low back pain episodes. Evidence is insufficient for specific worksite prevention programs or mechanical supports.

CLINICAL BOTTOM LINE

What elements of the history and physical examination should clinicians incorporate into the evaluation of low back pain?

When evaluating patients with low back pain, clinicians should identify features that may indicate a serious underlying cause (“red flags”) and psychosocial factors associated with development of persistent disabling pain (“yellow flags”), such as psychiatric conditions or maladaptive coping strategies.

History and physical examination should initially aim to identify emergencies, such as cauda equina syndrome. After emergencies have been ruled out, the goal of evaluation is to place the pain into 1 of 3 broad categories: non-specific low back pain (the majority of cases); pain due to radiculopathy or spinal stenosis; and pain potentially associated

with another specific spinal cause, such as cancer, infection, or rheumatologic causes. **Table 1** shows the history and physical examination findings, including key characteristics (“red flags”), for different causes of back pain.

Key elements of the physical examination to identify radiculopathy in persons with leg and back pain include checking for sensory or reflex loss or muscle weakness and evaluating for a positive result on a straight leg raise test (see the **Box: Physical Examination Maneuvers and Findings That Suggest Radiculopathy**). Limited spinal range of motion can be a sign of axial spondyloarthritis.

What factors should lead clinicians to suspect nerve root involvement?

Compression of the cauda equina (the area below the termination of the spinal cord) is an emergency and requires immediate imaging

Diagnosis

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Table 1. Common History and Physical Examination Features of Back Pain Causes

Disease	Characteristics on History	Physical Examination Findings	Notes
Common conditions associated with degenerative changes in the spine			
Degenerative disk disease	Nonspecific	Nonspecific	Common radiologic abnormality that may be related to symptoms
Degenerative disk disease with herniation	Sciatic/radicular pain (pain that radiates down the leg in a nerve root distribution)	Impaired ankle or patella reflex; positive result on ipsilateral or crossed straight leg raise test; great toe, ankle, or quadriceps weakness; lower-extremity sensory loss	Common cause of nerve root impingement and radicular symptoms, most commonly at L5 and S1 levels
Spinal stenosis	Severe leg pain; pseudoclaudication; no pain when patient is seated and improved with bending forward	Wide-based gait; pseudoclaudication; thigh pain after 30 s of lumbar extension	More common with advancing age; uncommon before age 50 y
Specific spinal causes of low back pain			
Ankylosing spondylitis and other axial spondyloarthritis	<i>Gradual onset; morning stiffness; improves with exercise; pain for >3 mo; pain not relieved when patient is supine*</i>	Decreased spinal range of motion	Usual onset before age 40 y
Osteomyelitis, spinal abscess, epidural abscess	<i>Recent infection or history of intravenous drug use*</i>	Fever and localized tenderness	Can cause cauda equina syndrome or cord compression
Cancer in the spine or surrounding structures	<i>Weight loss or other cancer symptoms; known past or current cancer diagnosis; failure to improve after 4 wk; no relief with bed rest*</i>	Localized tenderness	Metastatic disease, commonly from prostate, breast, and lung cancer; can cause cord compression; more common in patients aged ≥50 y
Cauda equina syndrome	<i>Bladder or bowel dysfunction (most commonly urine retention)</i>	Absent Achilles reflex; progressive neurologic dysfunction	Urgent surgical evaluation required; most commonly due to large midline disk herniation
Metabolic bone disease with or without compression fracture	Nonspecific pain; osteoporosis or osteoporosis risk factors <i>Trauma; corticosteroid use*</i>	Localized tenderness if vertebral fracture	Best example is osteoporosis with compression fracture
Nonspinal conditions that may be perceived as back pain			
Intra-abdominal visceral disease	Depends on affected viscera	Depends on affected viscera	Gastrointestinal: Peptic ulcer or pancreatitis Genitourinary: Nephrolithiasis, pyelonephritis, prostatitis, pelvic infection, or tumor Vascular: Aortic dissection All of these illnesses can cause pain in the area of the back but do not originate from the spine
Herpes zoster	Unilateral pain in distribution of dermatome	Unilateral dermatomal rash	Most common in elderly or immunocompromised patients
Psychosocial distress	Symptoms do not follow a clear clinical or anatomical pattern; psychological and emotional distress	Physical examination findings that do not follow a clear clinical or anatomical pattern	Patients with psychosocial distress and low back pain are at high risk for delayed recovery, chronic pain, and poor functional outcomes

* *Italicized text denotes "red flags" that can indicate a serious underlying condition.*

and surgical evaluation to prevent permanent neurologic damage. Signs and symptoms of cauda equina syndrome include bowel or bladder dysfunction (most commonly, urine retention), saddle (perineal) anesthesia, absent Achilles reflex, or progressive neurologic dysfunction.

Compression of the spinal cord at higher levels (above the conus medullaris) from conditions such as tumor or large central disk herniation can result in myelopathy, which also requires urgent specialist consultation (12). Myelopathy is characterized by upper motor neuron signs, including weakness, decreased motor control, altered muscle tone, and spasticity or clonus. Presence of severe or progressive motor deficits generally warrants urgent evaluation, regardless of the origin.

When patients present with back and leg pain, nerve root involvement at the level of the nerve root (radiculopathy) must be considered. Common causes include lumbar disk herniation in patients younger than 50 years and spinal stenosis in older patients. Spinal stenosis symptoms may also be due in part to neurovascular

compromise from compression of the spinal cord.

Patients with radiating leg pain that is worse than back pain, a positive result on a straight leg raise test, and unilateral lower-extremity neurologic signs and symptoms (reflex loss or sensory deficits) are very likely to have radiculopathy, most frequently from a herniated disk. The dominant sites for radiculopathy due to lumbar disk herniation are at L4–5 or L5–S1. Causes of leg pain that may coexist with low back pain but are not due to nerve root compression include piriformis syndrome, iliotibial band syndrome, trochanteric bursitis, and hip osteoarthritis.

Spinal stenosis can result in nerve root compression that may be bilateral, as well as pseudoclaudication, or leg pain that is exacerbated by changes in position, such as standing (also called neurogenic claudication). Vascular claudication can be difficult to distinguish from pseudoclaudication but is characterized by leg pain that occurs with exertion rather than position changes. Clinicians should consider vascular disease in patients with cardiovascular risk factors before attributing symptoms to spinal stenosis.

Physical Examination Maneuvers and Findings That Suggest Radiculopathy

Straight leg raise test: Passive lifting of the affected leg by the examiner to an angle less than 60 degrees reproduces pain radiating distally to the knee

Crossed straight leg raise test: Passive lifting of the unaffected leg by the examiner reproduces pain in the affected (opposite) leg

Diminished or absent patellar (L4 or L5 nerve root) or Achilles (S1 nerve root) reflex

Weakness of knee extension and ankle dorsiflexion (L4 nerve root), hallux extension and ankle plantar flexion (L5 nerve root), or ankle plantar flexion (S1 nerve root)

Sensory deficits in medial leg or foot (L4 nerve root), lateral leg or foot (L5 nerve root), or lateral side of foot (S1 nerve root)

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What serious underlying systemic conditions should clinicians consider?

Underlying systemic disease that causes back pain is uncommon but must be considered. Estimated prevalence is 4% for compression fracture (often related to metabolic bone disease), less than 1% for nonskin cancer, 0.3% for ankylosing spondylitis, and 0.01% for infection (13, 14).

A history of cancer is the strongest risk factor for cancer-related back pain (15). Unexplained weight loss, no relief with bed rest, pain lasting more than 1 month, and older age are also risk factors but increase the risk only slightly.

Osteomyelitis should be considered if there is a history of intravenous drug use, recent infection, or fever. Older age, trauma, and prolonged corticosteroid use are associated with vertebral compression fractures, which most often occur in persons with metabolic bone disease (osteoporosis) (15).

Ankylosing spondylitis or another axial spondyloarthritis should be considered in patients with morning stiffness, decreased discomfort with exercise, onset of back pain before age 40 years, slow onset of symptoms, and pain persisting for more than 3 months. Because of low specificity and low prevalence of axial spondyloarthritis, the positive predictive value of any single characteristic is low. Therefore, further evaluation should focus on persons with multiple characteristics.

Absence of any of these features makes a serious underlying condition unlikely. Having 1 or more features does not necessarily mean that a serious condition is present but may indicate the need for further evaluation.

Is classification of low back pain by symptom duration clinically useful?

Classifying back pain according to duration (acute, subacute, or chronic) is useful because the trajectory for improvement differs depending on symptom duration, and some therapies may differ in effectiveness depending on when they are administered.

Acute low back pain is often defined as lasting less than 4 weeks, though strong evidence for a specific duration is not available. In most patients, the cause cannot be determined with certainty but may be related to trauma or musculoligamentous strain. Most acute back pain resolves or improves within 4 weeks with self-care.

Chronic back pain is often defined as lasting longer than 12 weeks. Patients with chronic back pain often have little alleviation of their symptoms and are at risk for long-term pain or functional disability. People who have had back pain often experience recurrences and can develop repeated “acute-on-chronic” symptoms.

Subacute back pain, often defined as lasting 4 to 12 weeks after symptom onset, may be considered a transition period between acute and chronic back pain, during which improvement is not as pronounced as in the acute phase.

Do standardized assessment instruments have a role in evaluation?

Quantitative scales of pain and function are useful for judging the impact of low back pain and response to therapy. It is important to assess function as well as pain because pain severity does not necessarily correlate with effects on function. Questions addressing pain, back-specific function, general health status,

work disability, psychological status, and patient satisfaction can be used to assess the overall impact of low back pain. The presence of “high-impact” pain is based on pain severity, interference with activities, and functional status (16). Pain is commonly measured using a 10- or 100-point numerical or visual analogue rating scale. Commonly used functional measures include the Oswestry Disability Index (17) and the Roland-Morris Disability Questionnaire (18). A 1.5- to 2-point change on a 10-point pain scale (or equivalent), a 5-point change on the Roland-Morris scale, or a 10-point change on the Oswestry Disability Index have been proposed as thresholds for clinically meaningful change (19). Although most pain therapies have effects below proposed clinically meaningful changes, this does not necessarily mean they are useless. Estimated thresholds for clinically meaningful changes often vary substantially, patients differ in treatment response, and patients may value even small benefits when considering factors such as the costs and burdens of different treatments.

What psychosocial issues should clinicians consider when evaluating patients?

An important factor predicting the course of low back pain is the presence of psychosocial distress. Psychosocial distress is more common in patients with chronic low back pain, and addressing distress may help recovery. Clinicians should evaluate patients for psychiatric comorbid conditions, somatization, or maladaptive coping strategies, all of which are “yellow flags” associated with poor outcomes. Maladaptive coping strategies include fear avoidance (avoidance of work, movement, or other activities due to fear of damaging or worsening the back) and catastrophizing (excessively

negative thoughts and statements about pain and the future) (20). One trial found that using the STarT Back Screening Tool, which assesses pain, function, and psychosocial predictors of chronicity, to categorize patients' risk for a poor outcome and target interventions accordingly was more effective than usual care (12).

The presence of Waddell physical examination signs may indicate a nonorganic or psychological component to low back pain but does not seem to be a strong predictor. Waddell signs include nondermatomal distribution of sensory loss, pain on axial loading, nonreproducibility of pain when the patient is distracted, regional weakness or sensory change, and exaggerated and inconsistent pain responses (21).

A systematic review found that the presence of nonorganic signs, high levels of maladaptive pain coping behaviors, high baseline functional impairment, presence of psychiatric comorbid conditions, and low general health status were the strongest predictors of worse low back pain outcomes at 1 year (20). Variables related to the work environment were also associated with outcomes but were weaker predictors.

When should clinicians consider imaging studies?

Radiographic examinations are usually of limited use in patients with low back pain unless history or physical examination suggests a specific underlying cause. Radiographic findings correlate poorly with symptoms. Spinal imaging studies in asymptomatic persons commonly reveal anatomical findings, such as bulging or herniated disks, spinal stenosis, annular tears, and disk degeneration. Thus, presence of an anatomical abnormality does not mean it is the cause of the pain. Routine imaging also increases

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Table 2. Suggestions for Imaging in Patients With Acute Low Back Pain

<i>Imaging Action</i>	<i>Clinical Situations With Suggestions for Initial Imaging*</i>
Immediate imaging	<p>Radiography plus erythrocyte sedimentation rate†:</p> <ul style="list-style-type: none"> Major risk factors for cancer (new onset of low back pain with history of cancer, multiple risk factors for cancer, or strong clinical suspicion for cancer) <p>Magnetic resonance imaging:</p> <ul style="list-style-type: none"> Risk factors for spinal infection (new onset of low back pain with fever and history of intravenous drug use or recent infection) Risk factors for or signs of cauda equina syndrome (new urine retention, fecal incontinence, or saddle anesthesia) Severe neurologic deficits (progressive motor weakness or motor deficits at multiple neurologic levels)
Deferred imaging after trial of therapy	<p>Radiography with or without erythrocyte sedimentation rate:</p> <ul style="list-style-type: none"> Weaker risk factors for cancer (unexplained weight loss, age >50 y) Risk factors for or signs of ankylosing spondylitis (morning stiffness, improvement with exercise, alternating buttock pain, awakening due to back pain during the second half of the night, younger age [20s to 30s]) Risk factors for vertebral compression fracture (history of osteoporosis, use of corticosteroids, significant trauma, older age [>65 y for women, >75 y for men]) <p>Magnetic resonance imaging:</p> <ul style="list-style-type: none"> Signs and symptoms of radiculopathy (back pain with leg pain in an L4, L5, or S1 nerve root distribution; positive result on straight leg raise or crossed straight leg raise test) in patients who are candidates for surgery or epidural steroid injection Risk factors for or symptoms of spinal stenosis (radiating leg pain, older age, pseudoclaudication) in patients who are candidates for surgery
No imaging	<p>No criteria for immediate imaging and back pain alleviated or resolved after 1-mo trial of therapy</p> <p>Previous spinal imaging with no change in clinical status</p>

* From reference 22.

† Clinicians should consider magnetic resonance imaging if the initial imaging result is negative but a high degree of clinical suspicion for cancer remains.

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costs and is associated with increased health care use, including invasive procedures such as surgery, without improved patient outcomes or quicker return to work.

A guideline from the American College of Physicians and the American Pain Society recommends that clinicians not routinely perform imaging or other diagnostic tests in patients with non-specific low back pain. Rather, diagnostic imaging should be done in patients with severe or progressive neurologic deficits, when serious underlying conditions are suspected, after nonresponse to standard treatments, or when surgery or steroid injection is being considered (13). For example, radiography may be considered if history and physical examination suggest ankylosing spondylitis or vertebral compression fracture. Immediate magnetic resonance imaging is indicated if

there is suspicion of spinal infection, cord compression, or cauda equina syndrome. The American College of Physicians subsequently published best practice advice for high-value, cost-conscious low back imaging (**Table 2**) (22). The American College of Radiology and other groups also do not recommend routine imaging for low back pain (23).

In summary, usefulness of imaging increases as the pretest probability of underlying serious disease requiring surgical or other intervention increases. Normal findings on lumbar radiography do not exclude cancer or infection in someone at high risk for these conditions. For such persons, additional advanced imaging may be appropriate.

A systematic review of 6 RCTs found no difference between immediate lumbar imaging and usual care without immediate

imaging for pain or function at short-term (up to 3 months) or long-term (6 to 12 months) follow-up (24). Another systematic review of 1 to 3 RCTs found that early imaging was associated with increased health care use and potential increased likelihood of absence from work (25).

When should clinicians consider electromyography and other laboratory tests?

Additional diagnostic and laboratory tests are not indicated in most patients with low back pain. A highly elevated erythrocyte sedimentation rate is associated with cancer and might be considered

alongside diagnostic imaging in patients suspected of having cancer (26). Clinicians may consider electromyography and nerve conduction tests when there is diagnostic uncertainty about the relationship between leg symptoms and anatomical findings on advanced imaging, although evidence to define appropriate strategies for using such tests is lacking. Electrophysiologic tests can assess suspected myelopathy, radiculopathy, neuropathy, and myopathy. Electromyography might be unreliable in the acute phase, so testing should usually be reserved for patients with symptoms lasting at least 4 weeks.

Diagnosis... Clinical evaluation of patients with low back pain should focus on identification of features indicating a potential serious underlying condition, radiculopathy, and psychosocial factors associated with development of chronicity. Classifying low back pain as acute, subacute, or chronic informs the likely trajectory for improvement and treatment options. Most patients with acute symptoms do not require imaging tests, which should be reserved for patients with a high pretest probability of serious underlying systemic illness, fracture, cord compression, or spinal stenosis or for whom surgery is being considered.

CLINICAL BOTTOM LINE

What are reasonable treatment goals for clinicians and patients?

Most acute, nonspecific low back pain improves over time without treatment. Controlling pain and maintaining function while symptoms diminish on their own is the goal for most patients with acute low back pain. Clinicians should inform patients that back pain is common, that the spontaneous recovery rate is more than 50% to 75% at 4 weeks and more than 90% at 6 weeks, and that most people do not need surgery even if they have herniated disks.

Chronic low back pain can be difficult to treat, and exacerbations can recur over time. Patients should understand that the therapeutic goal is to maintain function, even if complete pain resolution is not possible. Addressing psychosocial factors associated with chronicity is critical, and patients should be encouraged to engage in managing their pain. Improvement in functional outcomes often depends more on addressing psychosocial factors and movement- and activity-focused interventions than on treatments aimed at symptomatic pain relief.

Treatment

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What psychosocial factors influence selection of treatments?

Assessment of psychosocial factors, such as depression, anxiety, maladaptive coping behaviors, unemployment, job dissatisfaction, somatization disorder, or psychological distress, identifies patients who may have delayed recovery and could help target interventions, such as supervised exercise therapy, cognitive behavioral therapy, mindfulness-based stress reduction, treatment of concomitant psychological conditions, or intensive multidisciplinary rehabilitation.

What advice should clinicians give on activity level and exercise?

Prolonged bed rest or inactivity is associated with worse outcomes for patients with acute, subacute, or chronic low back pain. Clinicians should encourage patients to maintain activity levels as near to normal as possible, though back-specific exercises do not need to be started while the patient is in acute pain. Although work might need to be modified on a short-term basis to accommodate recovery, most patients with nonspecific occupational low back pain can return to work quickly. Unless warning signs of serious underlying pathologic conditions are present, clinicians should encourage patients to minimize bed rest, to be as active as possible, and to return to work as soon as possible even if they are not entirely pain-free.

A 2010 systematic review of 10 RCTs investigating bed rest for patients with acute low back pain concluded that patients without sciatica who received advice for bed rest had slightly increased pain and worse functional recovery than those who were advised to continue normal activities (27).

Pain and functional outcomes were similar for patients with sciatica whether they had bed rest or remained active.

Various back-specific exercise programs that begin when acute symptoms subside have been advocated. Several types of exercise programs are effective in patients with low back pain, with no clear advantage of one over another (28). Therefore, patients may do best if they engage in exercises that they enjoy and can maintain. Yoga, which involves breathing and relaxation components as well as exercise, has also been shown to be effective. Clinicians should advise patients that attainment and maintenance of general physical fitness may help to prevent pain recurrences and is associated with other health benefits. Patients starting an exercise program may benefit from referral for supervised therapy, though motivated patients with access to information on exercise programs may prefer to self-refer or do it on their own.

A systematic review of 122 RCTs found that exercise was associated with greater pain relief than no exercise in patients with chronic low back pain (differences of about 1 point on a 10-point scale vs. no exercise) (28). In head-to-head trials, different exercise techniques were generally associated with similar outcomes. Evidence on acute pain was limited and inconsistent.

A systematic review of 18 RCTs of patients with chronic low back pain found that yoga was associated with beneficial effects on short- and long-term pain (difference of 0.5 to 1 point on a 10-point scale) and back-specific disability compared with no exercise (29). In head-to-head trials of yoga versus exercise, effects on pain and function were similar.

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Are complementary and integrative therapies effective?

Complementary and integrative therapies are commonly used for back pain. Interventions that probably have some benefit include spinal manipulation, massage, and acupuncture. Evidence on herbal therapies, such as cayenne, devil's claw, willow bark, comfrey, Brazilian arnica, and lavender essential oil, is limited but suggests possible benefit.

Glucosamine and chondroitin have unknown effectiveness. Bipolar magnets, the Feldenkrais method, and reflexology are probably ineffective.

A systematic review of 47 RCTs found lumbar spinal manipulation to be similar in effectiveness to recommended therapies for chronic low back pain and superior to nonrecommended therapies (30). A systematic review of 26 RCTs found lumbar spinal manipulation to be superior to other therapies or sham therapies for acute low back pain (pooled mean difference, -9.95 points [95% CI, -15.6 to -4.3 points] on a 100-point scale; standardized mean difference for function, -0.39 [CI, -0.71 to -0.07]) (31).

A systematic review of 25 RCTs found that massage was more effective for subacute and chronic low back pain than inactive controls for pain (standardized mean difference, -0.75 [CI, -0.90 to -0.60]) and function (standardized mean difference, -0.72 [CI, -1.05 to -0.39]) at short-term follow-up; benefits were smaller versus active controls (standardized mean differences of about -0.40) (32). However, the quality of the evidence was judged as low or very low. The evidence on massage for acute low back pain was extremely limited.

A systematic review of 33 RCTs found that immediately after treatment, acupuncture was associated with decreased pain levels (mean difference, -10.26 [CI, -17.11 to

-3.40] on a 100-point scale) and improved function (standardized mean difference, -0.47 [CI, -0.77 to -0.17]) versus no acupuncture (33). However, effects of acupuncture and sham acupuncture (needling placed in nonacupuncture points or pressure but no penetration at acupuncture points) were similar. Whether the effectiveness of sham acupuncture is due to some attribute of needling or manipulation of acupuncture points or is solely a placebo effect is unclear.

A systematic review of 3 RCTs found conflicting results and insufficient evidence to determine the effects of glucosamine for low back pain (34).

A systematic review of 14 RCTs of herbal therapy found some evidence that Capsicum frutescens (cayenne) reduces pain more than placebo (35). Evidence on Harpagophytum procumbens (devil's claw), Salix alba (white willow bark), Symphytum officinale L. (comfrey), Solidago chilensis (Brazilian arnica), and lavender essential oil suggested potential benefits, but the evidence was limited. The applicability of herbal therapy research studies to clinical practice is uncertain because commercial products involving herbal preparations are not strictly regulated and quality control is often uncertain.

What other physical interventions are effective?

Superficial heat, traction, transcutaneous electrical nerve stimulation, electrical muscle stimulation, ultrasound, low-level laser therapy, interferential therapy, short-wave diathermy, lumbar supports, and other physical modalities have been used to treat low back pain. Aside from superficial heat and low-level laser therapy, RCTs of these therapies have found little evidence of benefits, although they generally seem safe. Patient expectations of benefit and

placebo effects may play a role in their therapeutic value, but any potential benefits must be weighed against the costs of using unproven therapies.

A 2016 systematic review of non-pharmacologic therapies for acute and chronic low back pain assessed the benefits and harms of various physical modalities (interferential therapy, low-level laser therapy, lumbar supports, short-wave diathermy, superficial heat, traction, transcutaneous electrical nerve stimulation, electrical muscle stimulation, and ultrasound) (36). Evidence showing beneficial effects was lacking for these interventions, with the exception of superficial heat for acute pain and low-level laser therapy for chronic pain.

What psychological therapies are effective?

The best evidence on psychological approaches for low back pain is for cognitive behavioral therapy for subacute or chronic pain. Results for other types of psychological therapies are less conclusive. Psychological therapies may be most effective in persons with psychosocial risk factors. For patients with chronic disabling low back pain, particularly those with psychosocial risk factors, intensive interdisciplinary or multidisciplinary therapy consisting of physical, vocational, and behavioral interventions provided by multiple health care professionals is more effective than standard care and is an important treatment option. Mindfulness-based stress reduction, which utilizes some cognitive behavioral principles and seeks to enhance a person's ability to relax and cope with pain, has also been found to be effective, with benefits similar to those of cognitive behavioral therapy.

A systematic review of 23 RCTs found that cognitive behavioral therapy for subacute and chronic low back pain was associated with a small reduction in pain

(standardized mean difference, -0.23 [CI, -0.43 to -0.04]) and function (standardized mean difference, -0.19 [CI, -0.38 to 0.01]) versus wait list or usual care (37). Compared with guideline-based active treatments, effects were larger (standardized mean differences, -0.48 [CI, -0.93 to -0.04] for pain and -0.83 [CI, -1.46 to -0.19] for function).

A systematic review of 41 RCTs found multidisciplinary therapy for chronic low back pain to be more effective than usual care (standardized mean differences around 0.20) or physical treatments (standardized mean differences of 0.50 to 0.70) for reducing pain and disability (38).

A systematic review of 7 RCTs found that mindfulness-based stress reduction for chronic low back pain was associated with improved pain (mean difference, -0.96 [CI, -1.64 to -0.34] on a scale of 0 to 10) and function (standardized mean difference, -0.25 [CI, -0.41 to -0.09]) versus usual care (39). Effects of mindfulness-based stress reduction and active comparators (such as cognitive behavioral therapy) were similar.

When should drug therapies be considered, and which ones are effective?

Various drug therapies are used for low back pain (**Appendix Table**, available at [Annals.org](https://www.annals.org)). Their benefits are generally modest, averaging less than 1 point on a 10-point pain scale. Decisions to use drug therapies should be weighed against potential harms and the costs and burdens relative to other treatments. For patients who want symptom relief and wish to avoid the costs and burdens of therapies that require additional clinical visits (for example, psychological therapy) or who do not improve despite use of nonpharmacologic therapies, a short-term trial of drug therapy may be appropriate.

Nonsteroidal anti-inflammatory drugs (NSAIDs) are considered first-line drug therapy for low back pain. Although benefits are modest, NSAIDs are generally safe for short-term (days) use in appropriately selected patients (40, 41). Acetaminophen was previously considered first-line drug therapy, but a recent RCT found little or no benefit versus placebo (42).

Short courses of muscle relaxants or opioids should be considered as adjunctive therapy only for patients who do not respond to first-line analgesics. Muscle relaxants are more effective than placebo in relieving pain and symptoms (43). However, studies have not shown them to be more effective than NSAIDs, and they have more adverse effects, including sedation. Benzodiazepines are sometimes used as muscle relaxants but are not approved for this indication; lack evidence on effectiveness; and are associated with addiction and overdose potential, particularly in combination with other respiratory depressants, such as opioids (43). Therefore, they are not recommended for treatment of low back pain.

Although opioids are commonly prescribed for acute, subacute, and chronic low back pain, they have not been shown to be more effective than NSAIDs and are associated with more adverse effects, including the potential for addiction and overdose (44, 45). Opioids are not a first-line treatment for low back pain but may be appropriate for short-term use in patients with severe acute pain. Opioids should be used with caution for long-term treatment of chronic pain in carefully selected patients. Tools are available to assess opioid risk before prescribing, although accuracy is suboptimal (46). Guidelines on selection of patients for opioids and monitoring of patients prescribed opioids are available (47). Tramadol is a "dual-action" opioid agonist with effects on neuro-

transmitters as well as weak μ -opioid receptor affinity.

Antidepressants that seem effective to treat low back pain are those that inhibit norepinephrine reuptake (for example, serotonin-norepinephrine reuptake inhibitors) but not those lacking inhibition of norepinephrine reuptake (for example, selective serotonin reuptake inhibitors) (48, 49). The U.S. Food and Drug Administration has approved the serotonin-norepinephrine reuptake inhibitor duloxetine for chronic back pain. Depression is common in patients with chronic low back pain and should be assessed and treated appropriately. Antidepressants are not indicated for acute pain.

Anticonvulsants, such as gabapentin, pregabalin, topiramate, or carbamazepine, do not seem to be effective for low back pain with or without radiculopathy and increase risk for adverse events, despite being a recommended treatment for other types of neuropathic pain (49). Systemic corticosteroids do not alleviate chronic pain with or without radiculopathy (28).

What are the indications for surgical intervention?

Most cases of low back pain do not require surgery. Patients with suspected cord or cauda equina compression or spinal infection require immediate surgical referral for possible decompression or debridement to prevent loss of neurologic function. Signs that urgent surgical intervention may be necessary include bowel or bladder sphincter dysfunction, particularly urine retention or urinary incontinence; diminished perineal sensation, sciatica, or sensory motor deficits; and bilateral or unilateral motor deficits that are severe and progressive. Less urgent surgical evaluation is also appropriate in patients with worsening suspected spinal stenosis; neurologic deficits; or

intractable pain that is resistant to conservative treatment, particularly when weakness, reflex loss, or sensory loss is present. Standard surgery is posterior decompressive laminectomy for spinal stenosis and discectomy for herniated disk.

A systematic review of 7 RCTs found that surgery for lumbar radiculopathy with herniated disk was associated with decreased pain versus nonsurgical management at up to 26 weeks of follow-up (differences of 6 to 26 points on a scale of 0 to 100), but benefits did not persist at 1 year or later (50). Effects on function were mixed.

For lumbar spinal stenosis without spondylolisthesis, an RCT found that pain relief but not functional outcomes were better among patients assigned to surgery than among those assigned to nonsurgical care (51). However, crossover was high. In an as-treated analysis, benefits of surgery were greater than in the intention-to-treat analysis.

The role of surgery in patients with chronic back pain without neurologic findings is less clear. Spinal fusion is the most commonly performed surgery for nonradicular low back pain with degenerative findings. However, randomized trials of fusion surgery versus nonsurgical treatment with intensive multidisciplinary rehabilitation found no clear effects on pain or function.

A systematic review of 4 RCTs found that disability outcomes between fusion and nonsurgical treatment did not meet criteria for clinically meaningful differences (52). One trial found that fusion surgery was superior to unstructured nonsurgical therapy at 2 years of follow-up; the other 3 trials found no clear or clinically relevant difference between surgery and intensive interdisciplinary rehabilitation but were underpowered or had high crossover.

Because benefits are relatively small, use of interventional procedures should generally be reserved for patients who do not respond to standard treatments and should consider costs. Radiofrequency denervation for nonradicular pain that is presumed to originate from the facet joints may be associated with a small, short-term positive effect on pain (53). Epidural steroid injections are often given for patients with radiculopathy due to herniated disk; evidence indicates small short-term benefits that are not sustained (54, 55). Facet joint steroid injections, intradiscal electrothermal therapy, and percutaneous intradiscal radiofrequency thermocoagulation do not seem to be effective for nonradicular pain (56, 57).

How should clinicians follow patients with low back pain?

Follow-up based on the suspected cause and course of disease is an important component of management of low back pain.

Patients with uncomplicated acute pain who improve over 2 to 4 weeks may not require follow-up. Patients should be informed of the expected course of their pain and the need for follow-up after 3 to 4 weeks without improvement. Follow-up history should address patient response to treatment, resolution of symptoms, and development of complications. Clinicians should assess the probability of transition to the subacute or chronic phase. Patients with acute pain who are still moderately symptomatic at 4 weeks are more likely to develop chronic symptoms than those who report symptom alleviation. If recovery is delayed, clinicians should consider reevaluation for possible underlying causes and ensure that psychosocial factors are addressed. Development of symptoms of neurologic dysfunction or systemic disease should prompt additional evaluation.

Reinforcement of healthy lifestyle messages and patient education is an important part of management and prevention of recurrence. This should include advice on treatment and prognosis and recommendations on general exercise and fitness. In particular, patients should be encouraged to continue normal activities. For patients with chronic pain, individualized advice about the most appropriate exercise and functional activities is required. Regular follow-up may reinforce efforts and help overcome barriers to regular physical activity.

Treatment... Most acute nonspecific pain improves over days or weeks, even without medical intervention. Clinicians should discourage bed rest and encourage all patients to maintain normal activities as much as possible. When symptoms persist, clinicians should consider nondrug interventions, such as exercise therapy, psychological therapies, spinal manipulation, acupuncture, and massage. When drug therapy is considered, NSAIDs are first-line therapy. Short courses of muscle relaxants or opioids should be used cautiously, and serotonin-norepinephrine reuptake inhibitor antidepressants may be helpful in some patients with chronic symptoms. Psychosocial factors are strong predictors of outcomes, and evidence indicates the effectiveness of a risk-stratified approach to management.

Urgent surgical referral is indicated when infection, cancer, or cauda equina syndrome is suspected or for severe or progressive neurologic deficits. Nonurgent surgical referral may be appropriate for patients with persistent pain and signs of nonacute nerve compression or spinal stenosis.

CLINICAL BOTTOM LINE

Practice Improvement

What do professional organizations recommend for treatment of low back pain?

In 2007, the American College of Physicians and the American Pain Society released guidelines on the diagnosis and treatment of low back pain (13). The guidelines included 7 key recommendations to guide diagnosis and treatment. The American College of Physicians subsequently published advice for high-value, cost-conscious use of imaging (22) and released an updated guideline in 2017 that focused on treatment (58). The updated guideline emphasizes use of nonpharmacologic therapies as first-line treatment, given similar or superior benefits and fewer risks compared with drug therapies.

An overview of 15 low back pain guidelines published between 2008 and 2017 found that recommendations were generally similar across guidelines and largely consistent with the American College of Physicians guideline (59).

What is the role of patient education in the management of low back pain?

Patient education is important in the overall management of low back pain, and all patients should receive information about treatment of back pain and its prognosis. Information and advice about management of back pain should be individualized and relevant. Clinicians should inform patients that back pain is common, that the spontaneous recovery rate is more than 50% to 75% at 4 weeks and more than 90% at 6 months, and that most people do not need surgery even if they have herniated disks. Clinicians should advise patients to remain active, encourage weight control, and counsel patients about the role of psychosocial distress. For interventions associated with small benefits relative to harms (such as opioids, surgery for nonspecific pain, and interventional therapies), a shared decision-making approach is warranted.

A systematic review of 14 RCTs found that patient education was associated with increased reassurance versus usual care or control and decreased the number of low back pain-related primary care visits (60). Education delivered by physicians was more reassuring than education delivered by other practitioners (such as nurses or physiotherapists).

A systematic review of 7 RCTs found that neurophysiologic pain education was associated with small to moderate effects on pain and disability at short-term follow-up, based primarily on low-quality trials (61).

A randomized trial of 162 patients with back pain compared use of a booklet entitled "The Back Book" with more traditional educational materials (62). Patients who received the experimental booklet showed improvement in back pain beliefs and disability measures.

In the Clinic Tool Kit

Low Back Pain

Patient Information

<https://medlineplus.gov/backpain.html>

<https://medlineplus.gov/languages/backpain.html>

Information and handouts in English and other languages from the National Institutes of Health's MedlinePlus.

www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Fact-Sheets/Low-Back-Pain-Fact-Sheet
Fact sheet from the National Institute of Neurological Disorders and Stroke.

<https://familydoctor.org/condition/low-back-pain>

<https://es.familydoctor.org/condicion/lumbalgia>

Information in English and Spanish from the American Academy of Family Physicians.

Information for Health Professionals

www.acpjournals.org/doi/10.7326/M16-2367

2017 clinical practice guideline on noninvasive treatments for acute, subacute, and chronic low back pain from the American College of Physicians.

www.acpjournals.org/doi/10.7326/0003-4819-147-7-200710020-00006

2007 clinical practice guideline on diagnosis and treatment of low back pain from the American College of Physicians and the American Pain Society.

<https://acsearch.acr.org/docs/69483/Narrative>

Appropriateness criteria for low back pain from the American College of Radiology.

www.cdc.gov/mmwr/volumes/65/rr/rr6501e1.htm

2016 guideline on prescribing opioids for chronic pain from the Centers for Disease Control and Prevention.

In the Clinic

WHAT YOU SHOULD KNOW ABOUT LOW BACK PAIN

What Is Low Back Pain?

Many people have pain and stiffness in their lower back at some point. Most feel better within 4 weeks, but pain can persist or come and go over months or years.

What Causes It?

A cause is usually not found, but specific reasons may include:

- Bulging or rupturing of the disks that cushion the bones in your spine
- Narrowing of the open spaces in your spine (spinal stenosis)

Because back pain from a variety of sources often follows a similar pattern, these are often treated similarly unless the pain does not improve.

Low back pain can rarely be caused by a serious condition, such as cancer, infection, rheumatologic disease, or compression of the area below the end of the spinal cord. Signs or symptoms of these may include:

- Numbness in the leg, foot, groin, or rectal area
- Loss of bowel or bladder control
- Fever
- Recent infection or history of intravenous drug use
- Weight loss
- Current or past cancer
- Trauma
- Pain that is not relieved by lying down or does not improve after 3 to 4 weeks

Can It Be Prevented?

Risk factors for low back pain include:

- Obesity
- Physical inactivity
- Work that requires heavy lifting, bending, or twisting
- Bad posture
- Stress or depression

A healthy weight and lifestyle, daily physical activity, and good posture and lifting techniques may help prevent low back pain.

What Are the Symptoms?

Symptoms can range from muscle aches to a shooting, burning, or stabbing feeling. The pain may radiate down your leg or worsen with bending, twisting, lifting, standing, or walking.

Back pain is considered acute when it first starts. Most acute pain resolves within 4 weeks. Pain that lasts beyond 12 weeks is considered chronic and carries risk for long-term pain or decreased functioning. People who have had one pain episode may be at risk for repeated episodes of acute pain.

How Is It Diagnosed?

- Your doctor will ask you questions about your pain, your medical history, your daily activities, and your mental well-being.



- You will have an examination of your back and legs. Your doctor may ask you to perform certain movements to see how they affect your pain.
- Imaging tests are rarely needed for diagnosis because they usually do not help with treatment.

How Is It Treated?

- Low back pain usually occurs suddenly and improves within 3 to 4 weeks without treatment.
- Generally, the goal is to manage your pain so that you can maintain physical function while symptoms improve over time. Complete resolution of your pain may not be possible.
- Avoid bed rest or inactivity and try to keep doing normal everyday activities.
- Heat may relax your back muscles and decrease pain. Alternative therapies, such as massage, chiropractic care, and acupuncture, may also help.
- Psychological therapy (cognitive behavioral therapy) or mindfulness-based stress reduction may improve pain and function.
- If these do not help, ask your doctor about the risks and benefits of nonsteroidal anti-inflammatory medications (such as ibuprofen or naproxen), a muscle relaxant, or a specific type of antidepressant called duloxetine.
- Opioid medications should usually be avoided because anti-inflammatory medications are as effective and have fewer harms.
- Surgery is rarely needed.
- Various exercise programs may prevent pain from returning. You should pursue one that you enjoy and can stick with, maintain a healthy weight, and take care of your mental well-being with healthy coping strategies.

Questions for My Doctor

- What signs or symptoms could indicate a more serious condition?
- Are there activities I should avoid?
- Should I take medicine for my pain?
- When should I follow up with you if the pain doesn't go away?
- Are there alternative therapies that may help?
- Will an imaging test change my treatment?
- Are there exercises I can do to prevent future back pain?

For More Information



National Institute of Neurological Disorders and Stroke
www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Fact-Sheets/Low-Back-Pain-Fact-Sheet

MedlinePlus
<https://medlineplus.gov/backpain.html>

Appendix Table. Drug Treatments for Low Back Pain

<i>Treatment</i>	<i>Drug and Dosage</i>	<i>Mechanism of Action</i>	<i>Adverse Effects</i>	<i>Notes</i>
First-line treatment				
NSAIDs	Ibuprofen: 400-800 mg every 6-8 h (maximum daily dose, 2400 mg) Naproxen: 250-500 mg every 8-12 h (maximum daily dose, 1250 mg)	Decrease prostaglandins produced by the arachidonic acid cascade in response to noxious stimuli, thereby decreasing the number of pain impulses received by the CNS	GI upset or ulceration Decreased renal blood flow Inhibition of platelet aggregation Antipyretic effect may mask fever in patients for whom fever would be an important clinical clue COX-2-selective agents, and potentially NSAIDs, are associated with increased cardiovascular risk	First-line analgesic therapy for low back pain Generic agents are inexpensive No evidence that COX-2-selective agents are more effective than nonselective agents Anecdotal reports indicate benefit in patients with bone-related pain
Second-line treatment				
Muscle relaxants	Cyclobenzaprine: 5-10 mg 3 times daily Tizanidine: 4-12 mg 3 times daily	Reduce muscle spasm that may contribute to symptoms	Adverse CNS effects	Short courses can be considered as adjunctive therapy only when needed for patients who do not respond to first-line analgesics Muscle relaxants are more effective than placebo in reducing pain and alleviating symptoms, but studies have not shown them to be more effective than first-line analgesics Insufficient evidence to recommend one muscle relaxant over another
Antidepressants	Duloxetine: Start at 30 mg once daily and increase to 60 mg once daily after 1 wk if tolerated	Affect pathways that lead to neuropathic pain	Drowsiness, dry mouth, dizziness, and constipation were the most commonly reported adverse effects in available trials for low back pain Trials were not designed to assess serious adverse events, such as overdose, suicidality, or arrhythmias	Best evidence of effectiveness is for serotonin-norepinephrine reuptake inhibitors Tricyclic antidepressants associated with increased sedation and other anticholinergic adverse effects Should not be used for acute low back pain Antidepressants should be taken daily (rather than as needed) to result in benefits
Adjunctive treatment in selected patients (potential harm)				
Opioids	Codeine (alone or in acetaminophen with codeine): 30-60 mg every 4 h Hydrocodone (alone or with acetaminophen, aspirin, or ibuprofen): 5-10 mg every 4 h Oxycodone (alone or with acetaminophen): 5-10 mg every 4 h	Activate endogenous pain-modulating systems and produce analgesia by mimicking the action of endogenous opioid compounds	Constipation, nausea, and sedation are common adverse effects Dry mouth, itching, mental confusion, biliary spasm, urine retention, and myoclonus or respiratory depression (at high doses) are less common adverse effects Addiction potential	Evidence lacking to show greater efficacy than first-line analgesic agents Short courses of short-acting opioids can be considered as adjunctive therapy for patients who do not respond to first- and second-line analgesics Long-term opioid therapy for chronic pain should be reserved for carefully selected and monitored patients Use equianalgesic conversion to convert between different opioids and routes
Tramadol	25 mg of the immediate-release tablet by mouth every morning, increase in 25-mg increments every 3 d as tolerated to reach 25 mg 4 times daily, then increase by 50 mg every 3 d as tolerated to reach 50 mg 4 times daily; or 100 mg of the extended-release tablets by mouth daily, titrate in 100-mg increments every 5 d if needed, up to 300 mg/d	Centrally acting analgesic with dual mechanism of action μ -Opioid receptor agonist and weak inhibitor of norepinephrine and serotonin reuptake	Most common adverse reactions with extended-release oral tramadol, 100-400 mg/d, include flushing, insomnia, orthostatic hypotension, weakness, rigors, and anorexia Others include dizziness, vertigo, dry mouth, GI symptoms, diaphoresis, and CNS effects	Evidence that tramadol is more effective than placebo for short-term reduction in pain and improvement in function Trials comparing tramadol with first-line analgesics are lacking Concomitant use of extended-release and immediate-release tramadol is not recommended

Continued on following page

Appendix Table—Continued

Treatment	Drug and Dosage	Mechanism of Action	Adverse Effects	Notes
Not recommended because of ineffectiveness				
Acetaminophen	500-1000 mg every 4-6 h (maximum daily dose, 4 g)	Inhibition of prostaglandin synthesis in the CNS	Antipyretic effect may mask fever in patients for whom fever would be an important clinical clue Hepatotoxicity at high doses	No longer considered first-line therapy for low back pain due to ineffectiveness, although some patients may benefit Avoid doses >4 g/d, especially in patients who use combination products Relatively nontoxic at lower doses Inexpensive
Anticonvulsants	Gabapentin: 300-900 mg 3 times daily (start with 300 mg every night and titrate quickly to maximum of 3600 mg/d) Pregabalin: Start with 50 mg 3 times daily or 75 mg twice daily and titrate to maximum of 300 mg/d	Affect pathways that lead to neuropathic pain	Sedation Need to adjust gabapentin dose on the basis of renal function	Evidence indicates ineffectiveness for low back pain Can be expensive

CNS = central nervous system; COX-2 = cyclooxygenase-2; GI = gastrointestinal; NSAID = nonsteroidal anti-inflammatory drug.