LOW BACK PAIN

Background

Approximately 70 to 90% of adults during their lifetime experience acute low back pain, defined as pain lasting less than 6 weeks in duration. The cause of the back pain remains unknown in 85% of affected persons after appropriate initial investigation—a situation frustrating for both physician and patient. Frequent diagnoses in such cases include “acute lumbosacral strain,” “lumbago,” and “mechanical back pain.” These nonspecific, catch-all terms reflect the diagnostic challenge and lack of pathologic tests for low back pain. More accurately, these patients should be diagnosed with idiopathic low back pain. Regardless, most cases resolve spontaneously within 6 weeks. In recent studies on the management of acute low back pain, the most significant discovery—contradictory to traditional teaching from the 1980s—is the need for these patients, including those with sciatica symptoms, to avoid bed rest. Management recommendations for chronic back pain remain controversial, however, and the condition accounts for a significant proportion of costs to the health care system.

Epidemiology

In the ambulatory care setting the medical complaint of back pain is the fifth most common reason for a visit to a physician’s office, with 15 million annual visits in the United States, of which 7.3 million are to the emergency department (ED) at an average of 20,000 visits per day in 2008. Back pain was the leading cause of pain as reported in the 2010 National Health Interview Survey (NHIS), with 28.8% of the respondents reporting back pain lasting at least 1 day within the previous 3 months. Back pain primarily affects adults 30 to 60 years of age and has a tremendous impact on worker productivity, with significant economic consequences. It is the second leading cause of pain resulting in lost productive time from work, following headache. For aggregate hospitalization costs alone, it was the ninth most expensive condition in 2008 at more than $9.5 billion. Overall, patients with back pain account for billions of dollars in total direct and indirect costs in the United States.

The natural history of most cases of low back pain follows a benign and self-limited course. In a large pooled analysis, patients reported a decrease in back pain by 58% within 1 month. If the pain did not resolve within 3 months, however, it was unlikely to resolve after 12 months. The recurrence rate for pain was 66 to 84% within the first 12 months.

Risk factors for low back pain are continually being investigated. In a large systematic review, the presence of nonorganic signs of pain, poor pain-coping behaviors, great functional impairment, poor general health, and known psychiatric disease seem to predict patients who would develop chronic, disabling back pain in the future. Early evidence also points to a genetic predisposition to lumbar disk disease. Multiple other factors have been investigated, including body habitus, various occupations, deconditioning, tobacco smoking, stress levels, and psychological profile, with conflicting results.

PRINCIPLES OF DISEASE

Anatomy and Physiology

The lumbosacral spine consists of five lumbar vertebrae and the sacrum. Moving from anterior to posterior, each vertebra can be divided into the cylindrical vertebral body, two pedicles, two transverse processes, two overarching laminae, and a spinous process. These structures surround the neural canal, which houses the spinal cord and nerve roots and has a midsagittal anteroposterior diameter of 15 to 23 mm. The paired superior and inferior articulating processes join the articulating processes one vertebral level above and below. Each articulation site is called a facet joint. Intervertebral disks interpose between vertebral bodies, providing elasticity and stability to the vertebral column. Each disk consists of an inner colloidal gelatinous substance, the nucleus pulposus, and an outer capsule, the annulus fibrosus, which is thinner posteriorly than anteriorly (Fig. 54-1).

Various ligaments and muscles also provide stability to the lumbosacral spine. The anterior and posterior longitudinal ligaments course along the anterior and posterior surfaces of the vertebral bodies. The posterior longitudinal ligament forms a border between the intervertebral disks and the neural canal. As expected, because this ligament thins as it runs inferiorly from L1 to S1, 95% of lumbar disk herniations occur at the L4-5 and L5-S1 levels, causing pain and neurologic deficit in the L5 and S1 distribution. Most herniations extrude posterolaterally to impinge on a nerve root asymmetrically. The ligamentum flavum courses just anterior to the laminae within the neural canal. With age, this ligament can thicken, potentially causing spinal stenosis.

The spinal cord ends at the L1-2 interspace, and the lower cauda equina nerve roots extend inferiorly, exiting the sacral foramina as peripheral nerves to the lower extremity. Pain fibers supplying structures in the lumbosacral region primarily arise from the posterior rami and sinuvertebral nerves at each lumbar vertebral level. The nucleus pulposus and inner annular fibers of the intervertebral disk are unique in their lack of any pain fibers.
anatomic feature correlates consistently with magnetic resonance imaging (MRI) evidence of disk pathology in as many as 31% of asymptomatic patients. On follow-up, one study showed that abnormal disk findings in asymptomatic individuals did not predict the future development of back pain after 7 years. 21,22

Pathophysiology

Most conditions of low back pain have no proven cause. It is estimated that 85% of patients have no definitive diagnosis and are presumed to have pain originating from the soft tissue, including the muscles and ligaments. 10,20 In the other 15% of patients with a known cause, the pain may originate in the nerve root, the articular facets, or the bone itself.

In low back pain of nerve root origin, a spinal nerve root can become inflamed and painful with external impingement. Disk herniation, usually at the L4-5 and L5-S1 levels, is the most common cause of sciatica (i.e., pain radiating down the posterior leg from sciatic nerve root irritation). As the disk starts to descimate and degenerate, starting in their 30s, patients are at increased risk for outward herniation of the nucleus pulposus with consequent nerve root impingement. With further aging, these disks progressively shrink in size. In keeping with these findings, symptomatic disk herniations typically are found in patients 30 to 50 years of age. Local nerve ischemia from physical compression also may contribute to the inflammation and pain. Studies also show that exposure of the nucleus pulposus during disk herniation may result in local neural ischemia, leading to pain. 24 Nerve root impingement also can occur with spinal stenosis, a narrowing of the neural canal from congenital narrowing or, more often, from degenerative or hypertrophic changes of the disks, vertebral facet joints, and ligamentum flavum. 24

The two most critical conditions that cause nerve irritation are cauda equina syndrome and a spinal epidural abscess. Cauda equina syndrome is most commonly a result of a massive central disk herniation, usually compressing multiple, bilateral nerve roots and causing back pain radiating to both legs, saddle anesthesia, and impaired bowel and bladder function (i.e., diminished rectal tone and urinary retention, respectively). Emergent surgical decompression is indicated to preserve neurologic function. An epidural abscess similarly results in nerve root impingement, commonly with spinal cord involvement, causing significant back pain and ultimately neurologic deficits. These rare infections develop most commonly from the hematogenous spread of both methicillin-sensitive and methicillin-resistant Staphylococcus aureus. 20

Congenital and developmental spinal abnormalities also may cause back pain by nerve root inflammation in some cases, but much less frequently than was thought previously. Conditions such as kyphosis and scoliosis usually do not cause pain unless the degree of vertebral column misalignment is pronounced. 25 Similarly, spondylolisthesis (slippage of one vertebral body on another) does not usually cause pain if the slippage is less than 25% of the vertebral body width. Even in patients with higher grades of anterior slippage (anterolisthesis), the development of severe back pain is rare. Although it is one third as common as anterolisthesis, backward slippage (retrolisthesis) is almost always associated with back pain. Multifactorial causes of spondylolisthesis include degenerative changes and trauma. Degenerative lumbar spondylolisthesis in older patients occurs most often at the L4-5 level (7.4% overall population prevalence), followed by the L5-S1 level (1.9%) and the L3-4 level (1.7%). 26 Spondylolisthesis often is associated with bilateral pars interarticularis defects in the affected vertebra (spondylolysis).

In low back pain of articular facet origin, as with any other joint in the body, degenerative changes in the synovial articular facets in the lumbar sacral spine occur with age. Although the exact role and significance of articular facet joints in back pain are unclear, facet pathology has been suggested to contribute to 15 to 45% of chronic back pain cases. 27

In low back pain originating from bone, direct irritation of the vertebral bone and its periosteam can cause back pain. The causes of spondylitis (osteomyelitis of the axial skeleton) can range from a slowly progressing tuberculosis infection (Pott’s disease) to a more acute bacterial infection. Typically, bacteria seed the bone from a hematogenous source, such as from a skin wound or urinary tract infection, or directly from intravenous drug use. The most common bacterial culprit is Staphylococcus aureus. Primary and metastatic bone neoplasms can cause back pain from tumor infiltration into the bone. Primary bone tumors, such as multiple myeloma, chordoma, Ewing’s sarcoma, and osteosarcoma, occur 25 times less frequently than metastatic disease. 28 Of the neoplasms, breast, lung, prostate, thyroid, and kidney cancers and lymphoma are the most likely to metastasize to bone. Inflammatory conditions, such as ankylosing spondylitis, other arthropathies, and osteoporosis also can cause back pain. In osteoporosis the generalized decrease in bone mineralization can cause pain from microfractures of the vertebral column.

![Lateral and axial views of lumbar vertebral anatomy.](image)
Referred pain, most commonly from intraperitoneal and retroperitoneal abdominal pathology, also is considered in patients with back pain. Chronic back pain is complex and multifactorial. Not only are the structural causes unclear, but the nonphysical factors are variable and difficult to determine. Functional factors range from fear, depression, and personality disorders to financial motivation. Although it is likely that many of these patients do experience some kind of chronic pain, it is unknown why their pain then triggers depression, drug dependence, and malingering in some people but not in others. One difference may be the degree of disruption that the condition causes in the patient's lifestyle. A normally active and athletic person who is incapacitated is more profoundly affected than someone who is habitually sedentary. Psychological factors and potential compensation play a large role in the behavior of many patients with chronic back pain.\textsuperscript{12,17,29,30}

It has traditionally been taught that pediatric back pain results in a diagnosis more often than adult pain; however, this axiom has been called into question as multiple studies have shown an increasing number of children being diagnosed with nonspecific back pain, accounting for at least 50\% of cases, paralleling adults in pathophysiology.\textsuperscript{31-34} Children complaining of back pain require appropriate investigation. They may turn out to have spondyloysis with a variable degree of spondylolisthesis, Scheuermann’s disease (kyphosis and osteochondritis of the vertebral endplates), an infectious disease, or a neoplastic process. Disk herniation in children is comparatively rare, but when it does occur, the presentation is similar to that in adults.\textsuperscript{31}

**CLINICAL FEATURES**

**Signs and Symptoms**

A thorough history and physical examination are crucial in evaluating all patients with acute low back pain. The classic historical (Table 54-1) and physical findings with various entities associated with low back pain are reviewed in this section. Although most of these causative disorders are benign, four such disorders have been identified by the Agency for Healthcare Research and Quality (AHRQ) as “cannot miss” or “red flag” diagnoses: spinal fracture, cauda equina syndrome, spinal infection, and malignancy.\textsuperscript{35} A methodical and focused approach to the history and physical examination can help assess the patient’s pretest probability for each of these disease entities and determine whether further tests should be ordered.

**Uncomplicated Musculoskeletal Back Pain**

Most patients with back pain can be classified in the category of those with uncomplicated musculoskeletal back pain. These patients have no red flag findings in their history and on physical examination. Often, patients are unable to recall an inciting incident. The pain usually is characterized as an “ache” or “spasm” and is localized asymmetrically in the lumbar paraspinal muscle, with radiation to the buttock or posterior thigh proximal to the knee. Movement exacerbates the pain, and rest relieves it. No associated deficit in sensation, strength, or bowel or bladder sphincter tone is identified in the history or on the clinical examination. The sole physical findings may be regional lumbosacral tenderness and a limited range of motion of the lower back.

**Radiculopathy**

Approximately 1\% of all patients with low back pain exhibit signs of lumbar radiculopathy (i.e., nerve root irritation).\textsuperscript{35} The most common causative process is herniation of a lumbar disk; other causes include spinal stenosis, malignancy, and infection. The most common type of lumbar radiculopathy is an L5 or S1 radiculopathy causing sciatica symptoms. Patients with sciatica describe their pain as radiating from the low back to the legs, distal to the knee. Such pain is characterized as “shooting,” “lancing,” “sharp,” or “burning.” Associated symptoms include focal numbness or weakness in one of the lower extremities. Exacerbating triggers include sitting, bending, coughing, and straining; relieving factors include lying supine and still.

On physical examination the patient frequently exhibits tenderness to palpation in the sciatic notch. The straight leg raise (SLR) test is a fairly sensitive assessment tool to determine if the patient has sciatica. The SLR test is done with the patient supine and the legs extended. The symptomatic leg is passively raised while the knee is kept straight. The presence of back pain, which radiates past the knee when the leg is elevated 30 to 70 degrees, suggests an L5 or S1 radiculopathy. If the SLR test results in isolated low back pain without radiation symptoms to the legs, however, it is considered to be a negative finding. Through pooled analysis, the SLR test has a sensitivity of 91\% but a low specificity of 26\%, meaning that a negative result is fairly accurate in ruling out sciatica.\textsuperscript{36} Corroborative tests for sciatica include the “bowstring sign” (reproduction of pain with deep palpation of the taut “bowstring” posterior tibial nerve in the midline popliteal fossa) and reproduction of pain with foot dorsiflexion when the leg is elevated just short of the pain threshold during the SLR test. As an alternative to the SLR test, with the patient in a seated position, the knee can be extended (“flip test”), which also should stretch the sciatic nerve. Reproduction of the pain often causes the patient

<table>
<thead>
<tr>
<th>QUESTIONS FOR PATIENT</th>
<th>POTENTIAL DIAGNOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the back pain radiate down past the knees?</td>
<td>Radiculopathy and likely a herniated disk</td>
</tr>
<tr>
<td>Is the pain worse with walking and better with bending forward and sitting?</td>
<td>Spinal stenosis</td>
</tr>
<tr>
<td>Do you have morning back stiffness that improves with exercise?</td>
<td>Ankylosing spondylitis</td>
</tr>
<tr>
<td>Are you older than 50 years?</td>
<td>Osteoporotic fracture, spinal malignancy</td>
</tr>
<tr>
<td>Has there been any recent history of blunt trauma?</td>
<td>Fracture</td>
</tr>
<tr>
<td>Do you take long-term corticosteroids?</td>
<td>Fracture, spinal infection</td>
</tr>
<tr>
<td>Do you have a history of cancer?</td>
<td>Spinal metastatic malignancy</td>
</tr>
<tr>
<td>Does your pain persist at rest?</td>
<td>Spinal malignancy, spinal infection</td>
</tr>
<tr>
<td>Has there been persistent pain for longer than 6 weeks?</td>
<td>Spinal malignancy</td>
</tr>
<tr>
<td>Has there been unexplained weight loss?</td>
<td>Spinal malignancy</td>
</tr>
<tr>
<td>Is the pain worse at night?</td>
<td>Spinal malignancy, spinal infection</td>
</tr>
<tr>
<td>Are you immunocompromised (e.g., HIV infection, alcoholism, diabetes)?</td>
<td>Spinal infection</td>
</tr>
<tr>
<td>Have you had fevers or chills?</td>
<td>Spinal infection</td>
</tr>
<tr>
<td>Do you have pain, weakness, or numbness in both legs?</td>
<td>Cauda equina syndrome</td>
</tr>
<tr>
<td>Do you have bladder or bowel control problems?</td>
<td>Cauda equina syndrome</td>
</tr>
</tbody>
</table>

HIV, human immunodeficiency virus.
to lean backward reflexively from the pain, almost “flipping” back into a supine position.

A crossed SLR test is done by passively raising the patient’s asymptomatic leg while keeping the knee straight. The presence of pain radiating from the back to the opposite affected leg has a sensitivity of only 29% but a high specificity of 88% for sciatica, meaning that a positive result on crossed SLR testing is almost pathognomonic for sciatica, whereas a negative result is nondiagnostic.36

A reverse SLR test is performed to detect L3 or L4 radiculopathy. With the patient prone, each hip is passively extended. If there is irritation of the L3 or L4 nerve root, pain is elicited.

In addition to stressing lumbar nerve roots, a thorough examination of the lower extremities detects subtle abnormalities associated with radiculopathies. This examination includes mapping the distribution of pain and assessing individual nerve root function, specifically strength, sensation, and reflexes. For the sensory examination, the earliest deficit can be detected by examining the most distal aspect of the dermatome. Specifically, light touch and pinprick sensation should be tested on the medial foot (L4), in the area between the great and second toes (L5), and on the lateral foot (S1) (Fig. 54-2).

### Herniated Disk

Patients with symptomatic herniated lumbar disks usually are 30 to 50 years of age and often have a long history of recurrent nonradicular low back pain, theoretically from irritation of the outer annular fibers of the disk. When the nucleus pulposus of the disk prolapses through the annulus fibrosus, local nerve root inflammation and radiculopathy result. Coughing, sitting, and any movement in general exacerbate the patient’s pain and radiculopathy symptoms. The severity of leg pain from radiculopathy often overshadows the back pain. Sciatica findings have a sensitivity of 95% for lumbar disk herniation, meaning that herniation is extremely unlikely in the absence of sciatica.

The physical examination should focus on lower extremity neurologic function and signs of radiculopathy. Weakness of ankle dorsiflexion, great toe extension, ankle plantar flexion, and knee extension is associated with respective specificities of 70%, 70%, 95%, and 99% for lumbar disk herniation.20

### Spinal Stenosis

Patients with spinal stenosis are typically older (mean age of 55 years) and constitute only 3% of all patients with low back pain.4,37 The classic history, identified in 60 to 75% of patients with spinal stenosis, is one of subacute or chronic pain and lower extremity radiculopathy that occurs with walking and is relieved with rest and, uniquely, bending forward at the waist.38 Because these symptoms mimic peripheral vascular claudication symptoms, pain from spinal stenosis is termed pseudoclaudication. Typically, vascular claudication lasts 5 minutes after resting, whereas pseudoclaudication lasts 10 to 15 minutes. Patients with spinal stenosis obtain symptom relief with spine flexion and bending forward, because these maneuvers increase spinal canal diameter and reduce spinal cord tension. Similarly, sitting also helps to relieve the symptoms in these patients, in contrast with patients with herniated disks. A typical patient describes walking uphill without pain but experiencing pain on walking downhill, when the back is extended.

On physical examination, most patients are found to have a lumbar radiculopathy at one or multiple levels and increased back pain with extension.38 Classically, patients with spinal stenosis walk with a slightly bent-forward position. To help differentiate spinal stenosis from vascular claudication, peripheral pedal pulses and ankle-brachial indices should be checked.

### Degenerative Spondylolisthesis

Most cases of spondylolisthesis, forward displacement of one vertebral body over another, are caused by degenerative changes. This condition is most prevalent in adults older than age 50 and occurs most commonly at the L4-5 and L5-S1 junctions. Two thirds of older patients with radiographically documented degenerative spondylolisthesis are asymptomatic.39 For patients with pain,
bending, twisting, and lifting activities aggravate the symptoms. Radiculopathies, spinal stenosis symptoms, or both may coexist. On physical examination, clinical findings may include a loss of lumbar lordosis causing a change in posture, a step-off along the midline spine if the spondylolisthesis is severe, tight hamstrings resulting in decreased mobility of the hamstrings and subsequent “waddling” gait, or a radiculopathy.

**Arthropathies**

Inflammatory arthropathies, such as ankylosing spondylitis, rheumatoid arthritis, and psoriatic arthritis, all are associated with subacute and chronic low back pain. Patients with these conditions exhibit a decreased range of spinal flexibility. Commonly with ankylosing spondylitis, patients report morning back stiffness and pain relief with exercise. On physical examination, patients with an inflammatory arthropathy may have nonspecific manifestations, such as decreased spinal mobility, sacroiliac joint tenderness, and decreased chest expansion.

**Red Flag Diagnosis: Fracture**

In all patients who have experienced significant blunt trauma to the back or only minimal trauma in the setting of osteoporosis, fractures of the spinal column are considered. Chronic corticosteroid users deserve special attention, because they typically have developed some degree of osteoporosis. In a 20-year observation study of 2631 collagen vascular patients, vertebral fractures occurred in 23.9% of patients on high-dose corticosteroids as compared with only 2.6% of patients on no corticosteroids. Thus providers should have a low threshold to assess this unique patient population for a fracture despite the absence of trauma.

**Red Flag Diagnosis: Cauda Equina Syndrome**

Cauda equina syndrome results from a sudden compression of multiple lumbar and sacral nerve roots. Although it is an extremely rare presentation of back pain, it constitutes a neurosurgical emergency. The usual cause is a massive central disk herniation, but other potential causative disorders include spinal epidural abscess, hematoma, trauma, and malignancy. Patients with cauda equina syndrome have back pain and multiple-level radiculopathies, often involving both legs. Difficulty with bladder or bowel function, specifically urinary retention or decreased rectal tone, respectively, also may be a feature. Diagnostic dilemmas arise because the presentation can be atypical with equivocal neurologic compromise and only mild to moderate pain.

The most consistent examination finding in cauda equina syndrome is urinary retention. Patients often complain of overflow incontinence owing to a neurogenic bladder. Given the high sensitivity of urinary retention of 90% and a negative predictive value of 99.99%, this disease process is extremely unlikely if the patient’s postvoid residual urine volume is less than 100 to 200 mL. This can be measured by urethral catheterization or estimated by ultrasonography. Saddle anesthesia—sensory deficit over the buttocks, upper posterior thighs, and perineal area—frequently is an associated finding, with a sensitivity of 75%. In 60 to 80% of cases, the rectal examination reveals decreased sphincter tone.

**Red Flag Diagnosis: Spinal Infection**

Epidural abscess and spondylitis (osteomyelitis of the vertebral bone) are two types of dangerous spinal infections. Patients at higher risk include injection drug users, alcoholics, immunocompromised patients (e.g., patients with human immunodeficiency virus, diabetes mellitus, chronic renal failure, or long-term corticosteroid use), the elderly, patients who have sustained blunt trauma to the back, patients with an indwelling catheter or who have undergone recent dental instrumentation or instrumentation of the gastrointestinal or genitourinary tract or the spine, and patients with a recent bacterial infection. With spinal epidural abscess, however, approximately 20% of patients have no comorbid illnesses or risk factors. The most common bacterial culprit is *S. aureus*, spreading hematogenously from a remote site or from direct extension of a local infection, such as spondylitis or disk space infection. Less common culprits are streptococcal strains and enteric gram-negative bacilli. Patient history reveals back pain even at rest and subjective fevers. On physical examination, there is often tenderness to percussion over the spinous process near the abscess location. Spinal epidural abscess remains a diagnostic challenge despite the “triad” of fever, focal back pain, and neurologic deficit, because approximately 50% of the patients have no neurologic deficits, and 50% may be afebrile on initial presentation. With this subtle and often chronic presentation, many cases are misdiagnosed on initial presentation. Thus an awareness of this entity as a possible cause of low back pain is important for prompt diagnosis of this neurosurgical emergency, which carries a mortality rate as high as 15%.

With spondylitis, infection often begins as a subtle hematogenous seeding of the disk space, causing diskitis. Subsequent contiguous spread of the disk space infection causes vertebral endplate erosion, leading to spondylitis. As with a spinal epidural abscess, the most common bacterial culprit is *S. aureus*. Less commonly, enteric gram-negative bacilli and *Mycobacterium tuberculosis* (in Pott’s disease) are the infecting organisms. Injection drug users also are at risk for *Pseudomonas* spondylitis. The history typically reveals a more indolent course of back pain, with subjective fevers. The physical examination findings can range from nonspecific tenderness of the spine to radiculopathy and cauda equina syndrome. Similarly nondiagnostic, the presence of fever has a sensitivity of only 27 to 50% for spondylitis.

**Red Flag Diagnosis: Malignancy**

Vertebral infiltration with a tumor can be caused by either a primary or, more commonly, a metastatic malignancy. Classically, affected patients generally are older than 50 years and often complain of subacute or chronic back pain that is worse at night. In a systematic review, a history of known cancer, a moderately elevated erythrocyte sedimentation rate (ESR) (≥50 mm/hr), a significantly elevated ESR (>100 mm/hr), hematocrit less than 30%, and clinical judgment yielded positive likelihood ratios for a vertebral malignancy of 23.7, 18.0, 55.6, 18.2, and 12.1. On examination, patients typically have mild to moderate spinal tenderness. Examination of the organs in which tumors are most likely to metastasize to bone, including breast, prostate, and lung, is indicated.

**Referred Back Pain**

Referred pain often is difficult to differentiate from pain originating from the lumbosacral structures. It is vital, however, to make the distinction. A sudden onset of severe, “tearing” back pain is classically an aortic dissection. Abdominal pain radiating to the back may be caused by a ruptured abdominal aortic aneurysm in an elderly patient with atherosclerotic disease. Alternatively, abdominal pain radiating to the back could be from pancreatitis in a chronic alcoholic. Unilateral paraspinal pain associated with fever and nausea in a young woman could indicate pyelonephritis. Other examples of conditions radiating to the back include biliary diseases, pneumonia, pulmonary embolism, renal colic, and retroperitoneal hemorrhage. In all such cases, a thorough examination of the abdomen, genitourinary system, and cardiovascular
system is essential. Pinpointing the primary cause of the pain may radically alter the therapy for the patient.

Functional Back Pain

Distinguishing functional pain from “real” pain often is difficult, but several clues can be elicited from the history. A prolonged history of nonanatomic pain complaints, vague pain descriptions without localization, multiple lawsuits over similar problems, multiple prescriptions for narcotics from different providers, and lack of coordinated care for a problem that otherwise seems to dominate the patient’s life all suggest that a search for a physical cause would be fruitless. In such cases, secondary gain for the patient’s complaints often is likely.

On physical examination, maneuvers can be performed to try to detect functional back pain, if a psychological overlay is suspected. The first recommended maneuver is performing the SLR test from the sitting instead of the supine position. Seemingly focused on the knee examination, the physician extends the patient’s knee; this physiologically reproduces the SLR by stretching the L5 and S1 nerve roots. A positive response includes reproduction of the patient’s pain and extension of the back while seated to decrease traction on the sciatic nerve. A positive result on SLR testing in the supine position but a negative result in the seated position, and vice versa, suggests a nonphysiologic cause for the pain.

A second sign is apparent superficial tenderness. Some patients, to impress the physician with their degree of pain, respond dramatically to superficial palpation. This response is atypical for patients with genuine back pain. Nondermatomal sensory loss and widespread nondermatomal pain complaints also are unlikely to be caused by nonphysiologic processes.

Third, back pain should not be elicited by pushing down on the patient's scalp against the cervical spine. This maneuver axially loads only the cervical and not the lumbar spine.

Fourth, a patient who generally overreacts during the examination probably is not giving a true reflection of the actual discomfort. All of these signs are believed to correlate well with psychopathology but have poor prognostic value. They are suggestive of malingering and functional complaints but are neither sensitive nor specific enough to rule out organic pathology.31,32

Back Pain in the Elderly

In elderly persons with back pain, musculoskeletal processes and disk herniation are less likely causative disorders. Instead, spinal stenosis and degenerative spondylolisthesis should be considered. Also, the incidence of more worrisome diagnoses, such as an osteoporotic fracture, spinal infection, and malignancy, is much greater in this patient population. Consequently, in these cases the threshold for further investigation should be much lower.

Back Pain in Children

The likelihood of a congenital cause for back pain, such as leg-length discrepancy and spondylolisthesis, is greater for children than for adults. Spondylolisthesis is diagnosed most often in patients older than 10 years who are involved heavily in sports and complain of low back pain worsened with activity. In a retrospective study in an urban pediatric ED over a 1-year period, the most common causative disorders in patients with back pain complaints included direct trauma (25%), muscular strain (24%), sickle cell crisis (13%), idiopathic causes (13%), urinary tract infection (5%), and viral syndrome (4%).31 A history suggesting infection or malignancy in children is similar to that in adults. Radicular symptoms are relatively rare in children. Functional processes are suggested when the pain is present only with certain undesired activities, such as housework or chores.

DIAGNOSTIC STRATEGIES

Laboratory Evaluation

In the absence of historical and physical findings suggesting red flag diagnoses for low back pain, laboratory evaluation is unnecessary. When a patient's back pain is suggestive of a spinal infection or malignancy, however, laboratory studies may help with risk stratification. Specifically, a complete blood cell count, ESR, and urinalysis should be performed. Additional laboratory studies should be tailored to the patient’s history and physical examination findings. Liver function testing and determination of amylase or lipase level may be indicated to investigate abdominal complaints.

For a spinal infection, an ESR greater than 20 mm/hr has a sensitivity of 98%, and if the patient also has a spinal epidural abscess risk factor (e.g., diabetes, intravenous drug use history, chronic liver or kidney disease, recent spine procedure or indwelling spinal hardware, recent spine fracture, indwelling vascular catheter, immunocompromised state), then the sensitivity becomes 100% with a specificity of 67%.33 The serum white blood cell (WBC) count, in contrast, may or may not be elevated.34,35 In one study, 13 of 40 (33%) patients with a spinal epidural abscess had a falsely reassuring WBC count of less than 11,000/µL.45 Thrombocytopenia (<100,000/µL), an extremely high ESR (≥110 mm/hr), and cervical spine epidural abscess are poor prognostic indicators and predictive of relapses and death.36 When patients are diagnosed with a spinal infection, blood should be drawn for cultures because a single strain, most commonly S. aureus, can be isolated in 63 to 78% of the cases.47,55,57 Performing a lumbar puncture to evaluate the cerebrospinal fluid is unnecessary and is relatively contraindicated because of the risk of seeding the fluid with bacteria.

With a bony malignancy the ESR also usually is elevated, whereas the WBC count may be equivocal. The hematocrit may be low secondary to anemia of chronic disease. Other additional helpful laboratory tests include measurement of alkaline phosphatase, prostate-specific antigen assay, and serum immunoelectrophoresis and urine testing for light chains (for multiple myeloma).

Radiology

Plain Radiography

The utility of “screening” lumbosacral plain radiographs for all patients with acute low back pain is extremely low; however, approximately one third of all patients with back pain–related disorders receive plain films, with increasing trends toward advanced imaging, including computed tomography (CT) and MRI.58 Plain radiographs contribute little to patient management in the absence of concerning red flag findings and needlessly expose the patient to radiation.39 Most patients with back pain do not need radiographs. In those cases in which radiographs have been obtained, normal findings are usual, but incidental findings, which may or may not be the true cause of the patient’s pain, also are relatively common and may include spondylolisthesis, abnormal spinal curvature, disk space wedging, or degenerative changes.40 Currently accepted indications for radiographs in patients with back pain are listed in Box 54-1.

Patients with radicular symptoms suggesting a herniated disk do not require radiographs. In addition to being undetectable on plain radiographs, disk herniations resolve with conservative management in most cases.
If radiographs are obtained, anteroposterior and lateral views usually are sufficient in the ED, although many centers also prefer to obtain a cone-down lateral sacral view to improve visualization of the lumbosacral joint. Oblique views are not necessary except in children, in whom spondylolysis and spondylolisthesis may be more prevalent.60

On plain radiographs, spondylolisthesis, vertebral osteomyelitis, and vertebral metastatic disease have classic appearances. Spondylolisthesis (Fig. 54-3) is classified into grade 1 through grade 4 based on the severity of the anterior slippage of one vertebral body over another. Grade 1, which is often asymptomatic, involves less than 25% slippage. Grades 2, 3, and 4 involve 25 to 50%, 50 to 75%, and at least 75% slippage, respectively.

Spondylitis (Fig. 54-4) is characterized by erosion of contiguous vertebral endplates and a shortened disk space height, best seen on the lateral view. Because the anterior subchondral vertebral bone and disk space are highly vascular, it follows that spondylitis has a predilection for these areas because of the hematogenous spread of infection. With more advanced disease, vertebral bone erosion and collapse may occur.

Vertebral metastatic disease (Fig. 54-5) can manifest as either a blastic (hyperdense) or a lytic (hypodense) lesion and has a predilection for the vertebral body and pedicles. In contrast to osteomyelitis, in vertebral metastatic disease, the intervertebral disk space is spared.

If a red flag diagnosis is of concern, a plain radiograph may screen for a fracture but may not adequately rule out other pathologic processes, such as cauda equina syndrome, spinal infection, and malignancy. For cauda equina syndrome, patients more often have normal or nonspecific plain film findings because the most common cause is a central disk herniation. For spinal infection and vertebral malignancy, the sensitivity of a plain radiograph is only fair at 82% and 60%, respectively.59 In these cases, the patient subsequently should undergo MRI if the there is a high clinical suspicion.

### Indications for Plain Lumbosacral Radiographs in Patients with Low Back Pain

- Age younger than 18 or older than 50 years
- Any history of malignancy or unexplained weight loss
- Any history of fever, immunocompromised state, or injection drug use
- Recent trauma, other than simple lifting
- Progressive neurologic deficits or other findings consistent with cauda equina syndrome
- Prolonged duration of symptoms beyond 4 to 6 weeks

**Figure 54-3.** Lateral plain radiograph and schematic diagram of grade 2 anterior spondylolisthesis of L5 on S1. Grading is based on the percentage of slippage, with 0 to 25%, 25 to 50%, 50 to 75%, and greater than 75% corresponding to grades 1 to 4, respectively.

**Figure 54-4.** Lateral plain radiograph shows *Staphylococcus aureus* spondylitis of L3 and L4. There is narrowing of the L3-4 disk space and erosion of the vertebral endplates of L3 and L4 (small arrows). Note the distinct vertebral endplate margins in unaffected areas (large arrows).

### Ultrasonography

In suspected cases of cauda equina syndrome, one should consider use of bedside ultrasonography to assess the postvoid residual volume of the bladder to help with risk stratification. An estimate of the postvoid residual can be obtained by measuring the bladder with ultrasound with the following formula: Volume (mL) = 0.52 × height (cm) × width (cm) × depth (cm).41

### Computed Tomography and Magnetic Resonance Imaging

For assessment of fractures of the vertebral column, CT is superior to MRI. In the case of a fracture, CT helps to elucidate the integrity of the spinal canal and the risk for spinal cord impingement. For all other red flag diagnoses—cauda equina, spinal infection, and
650  PART II ♦  Trauma / Section Three ♦  Orthopedic Lesions

malignancy—MRI is the definitive investigative modality. Its superior tissue resolution, especially of the spinal cord and intervertebral disks, and its capability of generating more accurate sagittal reconstructions make MRI the ideal imaging modality. MRI is able to differentiate and detect subtle soft tissue pathology, such as a spinal epidural abscess (Fig. 54-6). No ionizing radiation exposure is incurred with MRI, whereas one CT scan of the entire spine exposes the patient to the equivalent of approximately 18.8 years of natural background radiation—cervical spine, 2 years; thoracic spine, 8.8 years; and lumbar spine, 8 years.64 For patients who have contraindications to MRI (e.g., pacemaker, metallic implants), a CT myelogram can be performed to assess for spinal cord impingement, cauda equina syndrome, and spinal epidural abscess. A spine CT scan can be performed to assess for vertebral bone infiltration by malignancies.

Although disk herniation is easily visualized on MRI, patients with findings consistent with an uncomplicated disk herniation (i.e., without objective findings of motor or sensory deficit on examination) should not routinely undergo MRI imaging because of the self-limited nature of the disease in most cases. Overimaging in patients with lumbar radiculopathy is costly and may lead to an overdiagnosis of disk herniations because incidental MRI-documented herniations have been shown to be present in 28 to 33% of asymptomatic patients. The result may be unnecessary surgical intervention.62

Special Investigations

Most cases of back pain in the ED do not require any diagnostic tests. Additional workup is warranted only when red flag conditions are suspected. Radionuclide scans have been used for locating suspected malignancy, infectious foci, and occult fractures as in spondylolysis. Nuclear medicine scans are regarded as sensitive but nonspecific.

DIFFERENTIAL CONSIDERATIONS

Nonspecific low back pain is in many ways a diagnosis of exclusion. In a typical patient, within the 18- to 50-year age range with acute low back pain and with no radiculopathy, previous malignancy, weight loss, risk factors for spinal infection, or fever, the diagnosis is almost certainly uncomplicated musculoskeletal back pain. When the patient falls outside of the aforementioned parameters, a wide variety of diagnostic possibilities should be entertained.

Almost anything can cause low back pain. Box 54-2 presents an extensive list of diagnostic considerations, but it is useful to look at the most common and most serious causes of low back pain other than musculoskeletal lumbar sacral pain. One of the most life-threatening causes of referred back pain is a leaking or ruptured abdominal aortic aneurysm. The reader is referred to appropriate chapters for further discussion of specific problems.

MANAGEMENT

Because most patients with acute low back pain without objective sensory or motor loss on examination experience symptomatic resolution within 4 to 6 weeks, only conservative management is needed. In general, MRI and surgery are reserved for the few patients who have worrisome systemic signs and patients with refractory, debilitating back pain. Over the past few decades, the accepted practice has shifted 180 degrees, from an overaggressive recommendation for invasive surgical intervention to the minimalistic recommendation of symptomatic pain control and early return to activity. In one large prospective study, the randomized intention-to-treat analysis found no significant difference in the outcomes of surgical versus nonsurgical treatment of degenerative spondylolisthesis.63 Thus the recommended role of the emergency physician in back pain management is to arrive at a correct diagnosis, rule out significant pathology, avoid excessive investigation, provide analgesia, and educate the patient.64 The management for various etiologic categories of disorders that may cause low back pain is summarized in Figure 54-7. For management of fractures and referred pain, the reader is referred to the appropriate chapters.

Uncomplicated Musculoskeletal Back Pain

Besides a thorough history and physical examination, no further investigations are required for uncomplicated low back pain. Only pain control and patient education are indicated. Aside from an initial parenteral opioid or nonsteroidal anti-inflammatory drug (NSAID), most patients can be managed with oral nonsteroidal medications. Ibuprofen is an ideal choice because it is inexpensive, but various NSAIDs can alternatively be used because they

Figure 54-5. Anteroposterior plain radiograph shows blastic infiltration of metastatic breast cancer to the pedicles of L3 to L5 (arrows).

Figure 54-6. Axial T2-weighted magnetic resonance imaging of Staphylococcus aureus L2 epidural abscess impinging on the dorsolateral aspect of the spinal canal. CSF, cerebrospinal fluid. (Image contributed by Dr. Stephen Bretz.)
have been shown to have similar efficacy. It is unclear whether NSAIDs are superior to acetaminophen, but it is known that acetaminophen has fewer side effects than NSAIDs. Selective cyclooxygenase-2 (COX-2) inhibitors are equally effective compared with NSAIDs, with fewer side effects than traditional NSAIDs; however, COX-2 inhibitors now are rarely used because NSAIDs are superior to acetaminophen, but it is known that acetaminophen has fewer side effects than NSAIDs. Selective cyclooxygenase-2 (COX-2) inhibitors are equally effective compared with NSAIDs, with fewer side effects than traditional NSAIDs; however, COX-2 inhibitors now are rarely used because of recent studies showing an increased cardiovascular risk in these medications probably do not provide a significant added benefit, but they do increase the incidence of side effects such as drowsiness, falls, accidents, and drug dependence. Corticosteroids are not significantly beneficial in the treatment of uncomplicated low back pain.

In terms of patient education, one of the outdated practices of back pain management was that physicians convinced patients that they were sick. This was done by excessively investigating and overtreating patients, restricting patients to strict bed rest, and taking them off work. It now has been shown convincingly and repeatedly that all of those interventions are unnecessary. Instead, patients should be educated about why they are not undergoing radiographic studies of their lumbosacral spine or laboratory tests and should be reassured of the likely benign course of the pain. Most patients can be convinced by education and an explanation of radiation dosage. A typical lumbosacral spine series involves as much gonadal irradiation as that incurred with a daily chest radiograph for 5 to 6 years. Patients also are discouraged from the outdated recommendation of strict bed rest. Compared with patients who are prescribed strict bed rest, patients with acute back pain who remain active experience earlier resolution of pain and return to work sooner. Patients should be made aware, however, that the back pain has a 66 to 84% likelihood of recurring within 12 months.

Other supplemental treatment modalities have been shown to be of debatable efficacy in the management of acute and chronic low back pain. These include acupuncture, physiotherapy, chiropractic manipulation, massage, ultrasound, traction, and transcutaneous nerve stimulation.

**Lumbar Disk Herniation**

Like patients with uncomplicated low back pain, patients with disk herniations and radiculopathy do not benefit from strict bed rest. In the acute setting, these patients should receive analgesics. Further investigation with laboratory tests and radiographs is not necessary. Most of these patients experience symptomatic resolution within 6 weeks with conservative, nonsurgical management.

Corticosteroid injections into the epidural space have been advocated for sciatica in the belief that this treatment helps to relieve some of the inflammation associated with disk herniation. Although some reduction of symptoms may be obtained initially, no long-term benefit or reduction in the need for later surgery has been documented. The use of systemic steroids in back pain...
and disk herniation remains controversial. Although there is no proven benefit, the anti-inflammatory effects make empirical sense in the context of radiculopathy. A large retrospective review showed no definite benefit of systemic steroids in either presentation, but the definitive trial is yet to be done.\textsuperscript{67} When the pain from disk herniation persists for longer than 4 to 6 weeks, outpatient MRI is indicated. With a documented herniation, these patients may benefit from surgical diskectomy, although this remains controversial compared with conservative management.\textsuperscript{80} Other potential indications for surgery include intractable pain and worsening motor or sensory deficit. Although surgical patients tend to have earlier relief of pain compared with nonsurgical patients, the 4- and 10-year results are the same. Microsurgery techniques and laser therapy have not been shown to confer any advantage over conventional techniques.\textsuperscript{81}

**Spinal Stenosis**

Patients with spinal stenosis should be managed conservatively with pain medications. In the absence of alarming red flag findings, these patients do not require laboratory or radiographic studies in the ED. These patients may be candidates for surgery if they show any of the following conditions: progressive neurologic deficit, progressive reduction in ability to walk secondary to pseudoclaudication, evidence of cauda equina syndrome, or intractable pain. Elective surgical decompression is more controversial. A 10-year longitudinal study showed that no findings predicted which patients would benefit more from surgery than from conservative management.\textsuperscript{82} The benefits of surgery also are weighed against the risks of surgery itself, because these patients usually are elderly.

**Degenerative Spondylolisthesis**

Patients with symptomatic degenerative spondylolisthesis are managed conservatively with analgesia and lifestyle changes, which include the avoidance of repetitive bending, heavy lifting, and twisting at the waist. For patients with refractory or severe back pain, outpatient MRI and neurosurgical referral for possible operative decompression are recommended.

**Red Flag Diagnosis: Fracture**

See Chapter 43, Spinal Injuries.

**Red Flag Diagnosis: Cauda Equina Syndrome**

Cauda equina syndrome is a neurosurgical emergency that requires urgent operative decompression to help preserve distal neurologic function. All patients with concerning findings, such as saddle anesthesia or a large postvoid residual volume, require emergent...
Musculoskeletal Back Pain

563

Red Flag Diagnosis: Spinal Infection

If findings on the history or physical examination are worrisome for a spinal infection, further investigation is of paramount importance. In low-risk patients, normal results on serum WBC count, ESR, and lumbar sacral plain radiograph can safely rule out infection. In patients with a moderate to high pretest probability for a spinal infection, the next step is to perform emergent MRI.

Pyogenic spinal infections should be treated with neurosurgical drainage and decompression, in addition to broad-spectrum intravenous antibiotics that cover at least for *S. aureus* and gram-negative bacilli until blood culture results return. Vancomycin should be included in the antibiotic regimen, given the increased prevalence of methicillin-resistant *S. aureus*. In a case series from 2003 to 2008, *S. aureus* accounted for 67% of the 45 cases of adult spinal epidural abscesses. Of this group, 41% were oxacillin/methicillin-resistant strains. For injection drug users, antibiotic coverage for *Pseudomonas* is necessary. The recent literature suggests that a nonsurgical management approach may be acceptable for a select group of patients at lower risk, such as those who are hemodynamically stable and neurologically intact.

Red Flag Diagnosis: Malignancy

Patients with a known malignancy who report back pain and have an associated neurologic deficit require emergent MRI to rule out spinal cord compression. However, patients who have no myelopathic findings pose a greater diagnostic challenge. A suggested algorithmic guideline in the diagnostic evaluation of back pain that is worrisome for malignancy involves subdividing patients into two categories: patients with and patients without a history of previous cancer. Development of spinal metastasis has been reported in 20 to 85% of patients with cancer. These patients are subdivided further into those with and those without evidence of a radiculopathy.

Most patients fall into the classification of *back pain without a history of cancer and without a radiculopathy*. They have a history that is only suggestive of a malignancy, such as unexplained weight loss or back pain that is worse at night. These patients require further risk stratification with plain radiographs (or a spine CT scan for patients with a high pretest probability for malignancy) and laboratory tests, including a complete blood cell count and ESR. With normal results, these patients can be referred to their primary care physician for further workup. The physician should not feel completely reassured that malignancy has been ruled out with plain films, however, because they have a false-negative rate of 10 to 17% for vertebral bone metastasis. This false-negative rate is likely a result of the fact that a cancer needs to erode at least 50% of the bone before becoming radiographically apparent on plain films. With abnormal results, such as a bone lesion or an extremely elevated ESR level (above 100 mm/hr), an urgent CT scan or MRI should be performed on an outpatient basis within the following 3 to 7 days, assuming that there are no neurologic deficits.

For patients *without a history of cancer but with signs of radiculopathy*, the workup also includes a plain radiograph, complete blood cell count, and ESR. If the test results are normal, the patient should be referred to his or her primary care physician for further evaluation for malignancy and other potential causes of radiculopathy, including spinal stenosis and disk herniation. If the workup shows a bone lesion on plain radiographs or an extremely elevated ESR level (greater than 100 mm/hr), the patient should undergo emergent MRI because (1) the presence of radiculopathy may be an early harbinger of impending spinal cord compression from a mass effect and (2) it often is difficult on plain radiography to distinguish between a neoplasm from early spondylitis (especially tuberculous osteomyelitis) and an osteoporotic fracture causing a vertebral collapse. If MRI is unavailable, multidetector CT imaging can be performed initially to screen for the presence of malignant bone infiltration, although definitive spinal cord and nerve root imaging will require MRI. The presence of a vertebral mass lesion on CT images suggests nerve root compression as a cause of the pain.

For patients with a history of previous cancer and low back pain, advanced imaging is indicated, either emergently or urgently within 3 to 7 days. In the absence of clinical manifestations of radiculopathy, these patients should undergo outpatient MRI (or CT, if MRI is not available or is contraindicated) regardless of plain radiography findings and laboratory results. Plain radiography is too insensitive to rule out a vertebral neoplastic process definitively. If a radiculopathy is present, however, these patients require emergent MRI regardless of plain radiography findings because of the concern for spinal cord compression. In a study of patients with a known diagnosis of cancer who had back pain and radiculopathy, the risk of epidural spinal cord compression was 25% despite normal radiographic findings, and 88% with radiographic evidence of vertebral metastasis.

In all patients undergoing emergent MRI to evaluate for vertebral malignancy and spinal cord compression or cauda equina syndrome, dexamethasone should be administered as soon as these conditions are suspected to reduce the potential mass effect. In the setting of a diagnosed neoplasm causing spinal cord compression or cauda equina syndrome, emergent radiation therapy and potentially spinal surgery should be arranged.

Pediatric Back Pain

Management of back pain in children is similar to management in adults and depends on the underlying causative disorder. Spondylolisthesis is managed by observation, with only 4 to 5% of cases worsening. Progression usually stops as skeletal maturity is achieved in the late teens. Current recommendations are for limited contact sports in children with less than 30 to 50% slippage who are asymptomatic with conservative therapy (activity, rest, physiotherapy, and brace) and avoidance of loading the spine in a hyperextended position. Surgical stabilization for children may be indicated with slippage greater than 30 to 50%. Treatment becomes more aggressive if the child is symptomatic or if radiologic evidence of further displacement is present.

Chronic Back Pain

Patients with chronic back pain often are regarded as the most challenging of all patients with back pain. The cause of chronic back pain is complex and multifactorial and usually requires a multidisciplinary approach for the greatest chance of success. Psychosocial factors, including depression, drug dependence, and financial gain, undoubtedly play a significant role in the behavior of many of these patients, making proper assessment and treatment extremely challenging in the ED.

After appropriate evaluation has ruled out a red flag cause for the back pain, ED management involves analgesia and referral for follow-up care. The main decision usually centers on the use of narcotics, which should be individualized in accordance with the physician’s assessment of the clinical scenario. Patients exhibiting
drug-seeking behavior classically are from out of town, have a primary care physician who cannot be contacted, or are reportedly allergic to all nonopioid medications.

DISPOSITION

Almost all patients with uncomplicated back pain can be discharged from the ED with follow-up with their primary care physician. In rare circumstances, severe pain or inadequate support for convalescence at home may preclude discharge. For patients who have a red flag diagnosis of spinal cord compression or cauda equina syndrome or spinal epidural abscess, immediate neurosurgical consultation is required for emergent surgical decompression. Although less emergently, consultation with a neurosurgeon or orthopedic spine specialist is necessary for patients with spine fractures, spondylitis, or a new vertebral malignancy in the absence of spinal cord or cauda equina involvement. Most patients with a spine fracture require hospitalization for pain control, fracture stabilization, and/or assessment of concurrent injuries. Some patients with stable fractures (e.g., small wedge fracture of the vertebral body) and tolerable pain can be managed on an outpatient basis. For patients with spondylitis, hospitalization will be necessary for administration of intravenous antibiotics. For patients with a vertebral malignancy, the decision to hospitalize the patient for pain control, administration of high-dose corticosteroids, and radiation therapy should be made in conjunction with a neurosurgeon, an oncologist, and a radiation therapist.

One of the most important aspects of management of low back pain is the discharge instructions for the patient. Not only are clear and simple directions useful to the patient, but they also constitute a medicolegal necessity for the physician. Physicians are advised to avoid use of purely medical terms. The discharge instruction should include the following:

1. **Diagnosis:** Distinguish between uncomplicated (musculoskeletal) back pain and diskogenic radiculopathy.
2. **Activity:** Recommend maintaining active mobility as limited only by pain, avoiding heavy lifting until symptoms resolve, and getting back to full activity as soon as possible. Also teach patients how to properly lift heavy objects in the future. This includes positioning the object closer to the body, standing with feet shoulder-width apart, keeping the back straight, tightening the abdominal muscles, and lifting with the knees.
3. **Reassurance:** Educate patients about the likely benign nature of the causative condition responsible for the pain.
4. **Warnings:** Instruct patients to return to the ED immediately if they experience any of the following: fever; loss of bladder or bowel control; numbness or tingling around the anus, vagina, or penis; or new pain or weakness down one or both legs.

In patients with pain secondary to spondylolisthesis, activity restrictions should be made in conjunction with an orthopedic surgeon. ED disposition for a patient with chronic back pain is relatively simple: pain management with nonopioids, when possible, and referral to a primary care physician for follow-up care. The prognosis is guarded because patients who are off work for 6 months usually are still off work after 2 years. Pediatric patients with back pain require the same discharge instructions as adults.

UPPER BACK PAIN

**Background**

Thoracic pain is far less common than low back pain. Thoracic pain usually has a musculoskeletal origin, but other, more emergent causes are considered first, including thoracic aortic dissection, pulmonary embolism, and esophageal disease. Compared with lumbar disk herniation, which is fairly common, thoracic disk disease is extremely rare, difficult to diagnose, and difficult to treat.

**Epidemiology**

The actual incidence of thoracic pain is unknown. The incidence of symptomatic thoracic disk disease is low, with estimates at 1 in 1 million. The average age is in the 40s with equal gender distribution. Surgery for thoracic disks accounts for less than 4% of all disk operations. Metastases are more common in the thoracic spine than in the lumbar spine, with 60 to 70% of spinal metastases localizing there.

**PRINCIPLES OF DISEASE**

**Anatomy and Physiology**

The thoracic vertebral column can be regarded as an extension of the cervical column with the addition of ribs. There are 12 thoracic vertebrae, connected by the anterior and posterior longitudinal ligaments and the ligamentum flavum, similar to the lumbar vertebral column. Also similarly, intervertebral disks provide elasticity and stability to the thoracic column. The spinal canal diameter remains unchanged through the thoracic and lumbar levels, but at the thoracic level, the space around the spinal cord is smaller than at the lumbar level. Because lumbar nerve fibers have not yet branched off from the spinal cord, the thoracic cord is thicker than the lumbar cord. Significant neurologic abnormalities may result from minimal spinal canal impingement at the thoracic level.

**Pathophysiology**

Common thoracic soft tissue pain is likely to be a combination of sprain and muscle inflammation. As in the lower back, innervation of the paravertebral area is provided by the sinuvertebral nerve, and any anatomic disruption of surrounding structures results in nonspecific pain. Thoracic disk herniations, which most commonly occur in the midthoracic to lower thoracic spine, cause pain and neurologic symptoms in much the same way as for lumbar disks. It is not clear why the clinical presentation is so varied, although a possible cause is a higher number of centrally herniated disks, resulting in much more frequent myelopathic symptoms.

**CLINICAL FEATURES**

**Symptoms and Signs**

**History**

Nondiskogenic thoracic back pain usually manifests as paraspinous discomfort. A history of trauma or recent unusual activity may or may not precede the onset of pain. Complaints with thoracic disk herniations are variable but usually are associated with long-standing pain, neurologic symptoms, or both. Pain may be localized to one part of the thoracic vertebrae, it may radiate down to the sacrum, or it may have a radicular component along the ribs. Central disk herniation can manifest as diffuse abdominal and back pain or a burning sensation in the lower extremities. Associated findings may include mild weakness, spasticity, gait disturbance, bowel or bladder dysfunction, and paraplegia. These usually progress until the condition is diagnosed. Because of the variable and often subtle signs and symptoms, thoracic disk disease typically is not diagnosed until 20 months after the first clinical presentation. Pain from other causes should be sought in the initial assessment. A history of trauma, fever, previous malignancy, cardiovascular disease, or gastrointestinal problems may indicate more worrisome conditions or those originating from outside the thoracic spine and may warrant further investigation.
Physical Examination

In patients with benign musculoskeletal pain, the physical examination fails to disclose evidence of a pathologic process. These patients may experience mild to moderate paraspinal tenderness to palpation, pain with motion, and even discomfort from chest wall expansion with respirations, but objective findings are minimal.

Physical findings in patients with thoracic disk herniation will vary with the location and degree of herniation. Objective findings may range from a normal-looking spine to loss of posterior column function (position, touch, vibration) or unilateral or bilateral weakness. Gait and sensory abnormalities are common. Hypotonic abdominal reflexes, elicited by scraping the skin tangential to the umbilicus in a particular quadrant, causing contraction of abdominal muscles in that quadrant, may be present with distal hyperreflexia. Babinski’s response may be present. Myelopathy may result in urinary retention. Muscle wasting may be present with chronic symptoms. The possibility of other pathologic conditions should be kept in mind during the physical examination, with appropriate assessment tailored to the presentation and level of clinical suspicion.

DIAGNOSTIC STRATEGIES

Laboratory Evaluation

In the face of unremarkable history and physical examination findings, the likelihood that laboratory evaluation will yield useful results is extremely small. In appropriate clinical circumstances, assessment for malignancy, infection, and inflammation should be undertaken.

Radiology

The usefulness of radiologic assessment is dubious in a patient with acute atraumatic thoracic back pain in whom preexisting illness or neurologic abnormalities are absent. As a general guide, however, the following factors should prompt basic radiologic studies and appropriate further investigations: clinical suspicion for presence of other conditions; unexplainable symptoms; extremes of age; concern for trauma, tumor, infection, gastrointestinal pathology, or vascular pathology; and prolonged symptoms. Like patients with lower back pain, patients with a history of cancer and upper back pain should undergo plain radiography (or CT or MRI for high-suspicion cases) to assess for vertebral metastatic disease, especially because metastases have a predilection for the thoracic spine.

MRI has become the modality of choice for evaluating a herniated thoracic disk. The incidence of asymptomatic disk herniations seen on MRI is 37%. Most herniated thoracic disks, whether symptomatic or not, have been reported to recede spontaneously.92

DIFFERENTIAL CONSIDERATIONS

Although muscular back pain is extremely common, Box 54-3 summarizes the important considerations in the expansive differential diagnosis for thoracic back pain.

MANAGEMENT

Commonly, thoracic musculoskeletal pain is managed with analgesia. No studies have shown the need for any difference in management from that for musculoskeletal back pain.

Thoracic disk disease is difficult to diagnose and manage. Symptomatic pain management and outpatient follow-up care are recommended. In view of the limited space in the spinal canal at the thoracic level compared with the lumbar level, spinal cord compression from a herniated disk is more likely at the thoracic level. Any disk herniation that precipitates an acute neurologic deficit warrants MRI and early neurosurgical evaluation.

DISPOSITION

Patients with benign back pain in any part of the thoracic vertebral column can be discharged with referral for follow-up care by the primary care physician. Patients with a suspected thoracic disk herniation require close outpatient follow-up. Most cases of subjective discomfort resulting from thoracic disk disease without objective neurologic findings resolve spontaneously, with one study showing a 77% improvement rate.92 Although clear guidelines are lacking for when emergent neurosurgical consultation is required for thoracic disk herniation, patients with significant pain or neurologic compromise should be assessed rapidly.

The references for this chapter can be found online by accessing the accompanying Expert Consult website.


