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Disorders of the Back and Neck

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Disorders of the Back

Low back pain is a common and costly medical problem. The lifetime prevalence of low back pain is estimated to be 70% to 85%, and the point prevalence is approximately 30%.[1] Each year, 2% of all American workers have a compensable back injury, and 14% lose at least one workday due to low back pain.[2] Among chronic conditions, back problems are the most frequent cause for limitation of activity (work, housekeeping, school) among patients under 45 years of age.[3] Acute low back pain is the fifth most common reason for a visit to the physician, accounting for 2.8% of all physician visits.[4] And nonsurgical low back pain is the fourth most common admission diagnosis for patients over 65.[5] Although difficult to estimate, the direct medical costs due to back pain totaled $33.6 billion in 1994. Indirect costs (i.e., lost productivity and compensation) are estimated to be as high as $43 billion.[6] In most cases, low back pain is treated successfully with a conservative regimen, supplemented by selective use of neuroradiological imaging, and appropriate surgical intervention for a small minority of patients.[7]

Background

Epidemiology

Low back pain affects men and women equally, with the onset of symptoms between the ages of 30 and 50 years. It is the most common cause of work-related disability in people under 45 years of age, and

is the most expensive cause of work-related disability.[8] Risk factors for the development of low back pain include heavy lifting and twisting, bodily vibration, obesity, and poor conditioning; however, low back pain is common even among patients without these risk factors.[1]

In cases of more severe back pain, occupational exposures are much more significant, including repetitive heavy lifting, pulling, or pushing, and exposures to industrial and vehicular vibrations. If even temporary work loss occurs, additional important risk factors include job dissatisfaction, supervisor ratings, and job environment (i.e., boring, repetitive tasks).[1] Factors associated with recurrence of low back pain include traumatic origin of first attack, sciatic pain, radiographic changes, alcohol abuse, specific job situations, and psychosocial stigmata.

Of patients with acute low back pain, only 1.5% develop sciatica (i.e., painful paresthesias and/or motor weakness in the distribution of a nerve root). However, the lifetime prevalence of sciatica is 40%, and sciatica afflicts 11% of patients with low back pain that lasts for more than two weeks.[9,10] Sciatica is associated with long-distance driving, truck driving, cigarette smoking, and repeated lifting in a twisted posture. It is most common in the fourth and fifth decades of life, and peaks in the fourth decade. Most patients with sciatica, even those with significant neurological abnormalities, recover without surgery.[11] Only 5% to 10% of patients with persistent sciatica require surgery.[5,12]

Despite the incidence and prevalence of low back pain and sciatica, the major factor responsible for its societal impact is disability.[12] The National Center for Health Statistics estimates that 5.2 million Americans are disabled with low back pain, of whom 2.6 million are permanently disabled.[13] Between 70% and 90% of the total costs due to low back pain are incurred by the 4% to 5% of patients with temporary or permanent disability.[12] Risk factors for disability due to low back pain include poor health habits, job dissatisfaction, less appealing work environments, poor ratings by supervisors, psychological disturbances, compensable injuries, and history of prior disability.[12] These same factors are associated with high failure rates for treatments of all types.

Natural History

Recovery from nonspecific low back pain is usually rapid. Approximately one third of patients are improved at one week, and two thirds at seven weeks. However, recurrences are common, affecting 40% of patients within six months. Thus, "acute low back pain" is increasingly perceived as a chronic medical problem with intermittent exacerbations.[14]

Low back pain may originate from many structures, including paravertebral musculature, ligaments, the annulus fibrosus, the spinal nerve roots, the facet joints, the vertebral periosteum, fascia, or blood vessels. The most common causes of back pain include musculoligamentous injuries, degenerative changes in the intervertebral discs and facet joints, spinal stenosis, and lumbar disc herniation.[14]

The natural history of herniated lumbar disc is usually quite favorable. Only about 10% of patients who present with sciatica have sufficient pain at six weeks that surgery is considered. Sequential magnetic resonance imaging (MRI) shows gradual regression of the herniated disc material over time, with partial or complete resolution in two thirds of patients by six months.[14] Acute disc herniation has changed little from its description in the classic article of Mixter and Barr: the annulus fibrosus begins to deteriorate by age 30, which leads to partial or complete herniation of the nucleus pulposus, causing irritation and compression of adjacent nerve roots.[5,15,16] Usually this herniation is in the posterolateral position, producing unilateral symptoms. Occasionally, the disc will herniate in the midline, and a large herniation in this location can cause bilateral symptoms. More than 95% of lumbar disc herniations occur at the L4–L5 or L5–S1 levels.[10] Involvement of the L5 nerve root results in weakness of the great toe extensors and dorsiflexors of the foot, and sensory loss at the dorsum of the foot and in the first web space. Involvement of the S1 nerve root results in a diminished ankle reflex, weakness of the plantar flexors, and sensory loss at the posterior calf and lateral foot.

Among patients who present with low back pain, 90% recover within six weeks with or without therapy.[17] Even in industrial settings, 75% of patients with symptoms of acute low back pain return to work within one month.[17] Only 2% to 3% of patients continue to have symptoms at six months, and only 1% at one year. However, symptoms of low back pain recur in approximately 60% of cases over the next two years.

Demographic characteristics such as age, gender, race, or ethnicity do not appear to influence the natural history of low back pain. Obesity, smoking, and occupation, however, are important influences.[18] Adults in the upper fifth quintile of height and weight are more likely to report low back pain lasting for two or more weeks.[9,18] Occupational factors that prolong or delay recovery from acute low back pain include heavier job requirements, job dissatisfaction, repetitious or boring jobs, poor employer evaluations, and noisy or unpleasant working conditions.[16] Psychosocial factors play an important role in the natural history of low back pain, modulating response to pain, and promoting illness behavior. The generally favorable natural history of acute low back pain is significantly influenced by a

variety of medical and psychosocial factors that the practicing physician must be familiar with in order to counsel patients regarding prognosis and treatment.

Clinical Presentation

History

Low back pain is a symptom that has many causes. When approaching the patient with low back pain, the physician should consider three important issues. Is a systemic disease causing the pain? Is the patient experiencing social or psychosocial stresses that may amplify or prolong the pain? Does the patient have signs of neurological compromise that may require surgical evaluation?[14] Useful items on medical history include: age, fever, history of cancer, unexplained weight loss, injection drug use, chronic infection, duration of pain, presence of nighttime pain, response to previous therapy, whether pain is relieved by bed rest or the supine position, persistent adenopathy, steroid use, and previous history of tuberculosis.[14] Factors that aggravate or alleviate low back pain should also be elicited. Nonmechanical back pain is usually continuous, whereas mechanical back pain is aggravated by motion and relieved by rest. Low back pain that worsens with cough has traditionally been associated with disc herniation, although recent data indicate that mechanical low back pain also worsens with cough. The presence of leg weakness or leg paresthesias in a nerve root distribution is consistent with disc herniation. Bowel or bladder incontinence with or without saddle paresthesias suggests the cauda equina syndrome; this is a surgical emergency and requires immediate referral to a surgeon. Hip pain can mimic low back pain, and is often referred to the groin, the anterior thigh, or the knee, and is worsened with ambulation. Patients with osteoarthritis or degenerative joint disease report morning stiffness, which improves as the day progresses. Patients with spinal stenosis report symptoms suggestive of spinal claudication, that is, neurological symptoms in the legs that worsen with ambulation. Spinal claudication is differentiated from vascular claudication in that the symptoms of spinal claudication have a slower onset and slower resolution. A history of pain at rest, pain in the recumbent position, or pain at night suggests infection or tumor as a cause for low back pain. Osteoporosis is a consideration among postmenopausal women or women who have undergone oophorectomy. These patients report severe, localized, unrelenting pain after even "minor" trauma. Patients who present writhing in pain suggest the presence of an intra-abdominal process or vascular cause for the pain, such as abdominal aortic aneurysm.

Physical Examination

The initial examination is fairly detailed. With the patient standing and appropriately gowned, the examining physician notes the stance and gait, as well as the presence or absence of the normal curvature of the spine (e.g., thoracic kyphosis, lumbar lordosis, splinting to one side, scoliosis). The range of motion of the back is documented, including flexion, lateral bending, and rotation. Intact dorsiflexion and plantar flexion of the foot is determined by observing heel-walk and toe-walk. Intact knee extension is determined by observing the patient squat and rise, while keeping the back straight.

With the patient seated, a distracted straight-leg raising test is applied. With the hip flexed at 90 degrees, the flexed knee is brought to full extension. A positive straight-leg raising test reproduces the patient's paresthesias in the distribution of a nerve root at <60 degrees of knee extension. Sensation to light touch and pinprick are examined and motor strength of hip and knee flexors is tested. The deep tendon reflexes are tested [knee jerk (L4), ankle jerk (S1)] and long tract signs are elicited by applying Babinski's maneuver (Table 1.1).

With the patient in the supine position, the straight-leg raising test is repeated. With the hip and knee extended, the leg is raised (i.e., the

Table 1.1. **Motor, Sensory, and Deep Tendon Reflex Patterns Associated with Commonly Affected Nerve Roots**

Nerve root	Motor reflexes	Sensory reflexes	Deep tendon reflexes
C5	Deltoid	Lateral arm	Biceps jerk (C5,C6)
C6	Biceps, brachioradialis, wrist extensors	Lateral forearm	Brachioradialis
C7	Triceps, wrist flexors, MCP extensors	Middle of hand, middle finger	Triceps jerk
C8	MCP flexors	Medial forearm	—
T1	Abductors and adductors of fingers	Medial arm	—
L4	Quadriceps	Anterior thigh	Knee jerk
L5	Dorsiflex foot and great toe	Dorsum of foot	Hamstring reflex (L5, S1)
S1	Plantarflex foot	Lateral foot, posterior calf	Ankle jerk

MCP = metacarpophalangeal.

hip is flexed). A positive test reproduces the patient's paresthesias in the distribution of a nerve root. Isolated low back pain does not indicate a positive straight-leg raising test. The crossed straight-leg raising test (i.e., reproduction of the patient's symptoms by straight-leg raising of the contralateral leg) is very specific for acute disc herniation, and suggests a large central disc herniation. The examining physician should realize that the straight-leg raising test is sensitive but not specific, whereas the crossed straight-leg raising test is specific but not sensitive.[14] Hip range of motion is then tested, and pain radiation to the groin, anteromedial thigh, or knee is documented.

A more detailed examination may be necessary in selected patients. If significant pathology is suspected in a male patient, the cremasteric reflex is tested; i.e., application of a sharp stimulus at the proximal medial thigh should normally cause retraction of the ipsilateral scrotum. With the patient in the prone position, the femoral stretch test is applied. While the hip and knee are in extension, the knee is flexed, placing increased stretch on the femoral nerve, which includes elements from the L2, L3, and L4 nerve roots (i.e., the prone knee-bending test). The hamstring reflex is tested by striking the semitendinosus and semimembranosus tendons at the medial aspect of the popliteal fossa. The hamstring reflex involves both the L5 and S1 nerve roots. Thus, an absent or decreased hamstring reflex in the presence of a normal ankle jerk response (S1) implies involvement of the L5 nerve root (Table 1.1). Sensation in the area between the upper buttocks is tested, as well as the anal reflex and anal sphincter tone (S2, S3, S4).

The clinical diagnosis of acute disc herniation requires repeated physical examination demonstrating pain or paresthesias localized to a specific nerve root, with reproduction of pain on straight-leg raising tests, and muscle weakness in the nerve-appropriate root distribution.

Diagnosis

Radiology

Plain Radiographs. Plain radiographs are usually not helpful in diagnosing acute low back pain, because they cannot demonstrate soft tissue sprains and strains, or an acute herniated disc. However, plain radiographs are useful in ruling out conditions such as vertebral fracture, spondylolisthesis, spondylolysis, infection, tumor, or inflammatory spondyloarthropathy[5,19] (Fig. 1.1). In the absence of neurologic deficits, plain radiographs in the evaluation of low back pain should be reserved for patients over 50 years of age, patients with a temperature

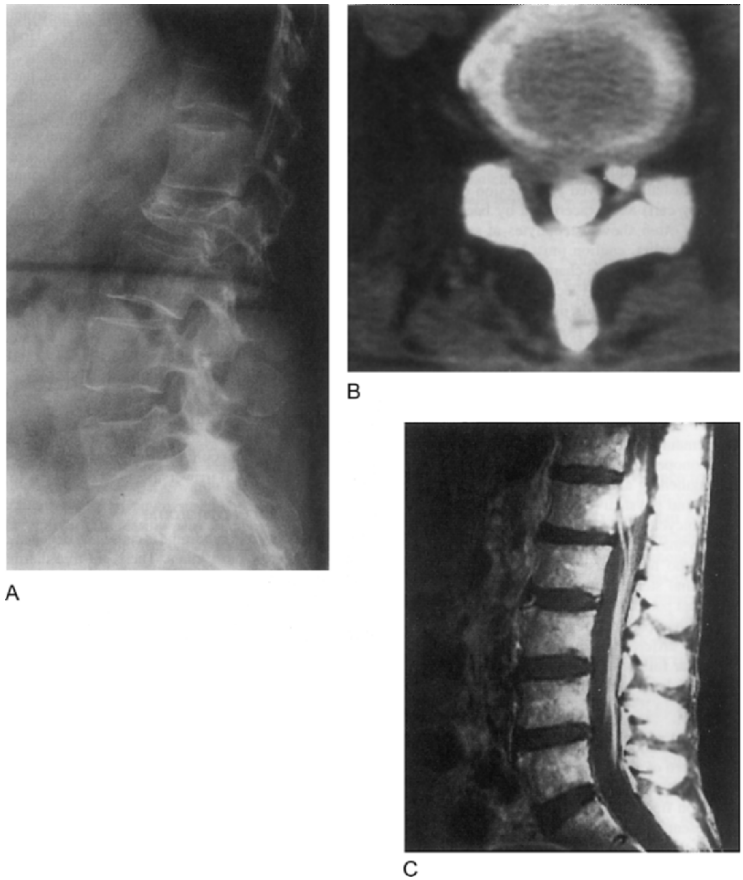

Fig. 1.1. Radiologic studies of the lumbar spine. (A) Plain radiograph demonstrating a compression fracture of the L2 vertebral body due to multiple myeloma. (B) CT scan demonstrating nucleus pulposus herniating posteriorly into the spinal canal. (C) MRI demonstrating an enhancing intramedullary metastatic lesion in the cauda equina at the L1 level.

>38°C, patients with anemia, a history of trauma, previous cancer, pain at rest, or unexplained weight loss, drug or alcohol abuse, steroid use, diabetes mellitus, or any other reason for immunosuppression.[20] For selected patients, initial plain radiographs of the spine in the early evaluation of acute low back pain should include anteroposterior and lateral views of the lumbar spine.[15] Oblique views are used to rule out

spondylolysis, particularly when evaluating acute low back pain in young athletic patients active in sports such as football, wrestling, gymnastics, diving, figure skating, or ballet.[21] If the patient's pain fails to improve after four to six weeks of conservative therapy, radiographs should be obtained; such patients may be at risk for vertebral infection, cancer, or inflammatory disease.[22]

For patients 65 years of age and older, diagnoses such as cancer, compression fracture, spinal stenosis, and aortic aneurysm become more common. Osteoporotic fracture may occur even in the absence of trauma. Because hormone replacement therapy and other medications may prevent further fractures, early radiography is recommended for older patients with back pain.[14]

Radiographic abnormalities are nonspecific and are observed equally in patients with and without symptoms of low back pain.[23] Clinical correlation is essential before symptoms of low back pain can be attributed to radiographic abnormalities.

CT, MRI, and Myelogram. Computed tomography (CT), myelogram, and magnetic resonance imaging (MRI) each have a specific role in evaluating a select subset of patients with low back pain. Physicians must be aware that many asymptomatic patients demonstrate disc bulging, protrusion, and even extrusion.[5,24] For example, 30% to 40% of CT scans and 64% of MRIs demonstrate abnormalities of the intervertebral disc in asymptomatic patients.[7,24]

CT or MRI should be reserved for patients in whom there is strong clinical suggestion of underlying infection or cancer, progressive or persistent neurological deficit, or cauda equina syndrome therapy.[5,14] CT or MRI should be considered for patients who show no response to a four- to six-week course of conservative therapy.[5] CT and MRI are equally effective in detecting disc herniation and spinal stenosis, but MRI is more sensitive in detecting infection, metastatic cancer, and neural tumors.[14] Myelography is useful in differentiating significant disc herniation from incidental disc bulging not responsible for the patient's signs or symptoms, but has largely been replaced by noninvasive techniques such as MRI or CT.[15] CT myelography is sometimes used in planning surgery.[14]

Ancillary Tests

Because plain radiographs are not highly sensitive for detection of early cancer or vertebral infection, tests such as erythrocyte sedimentation rate (ESR) and complete blood count (CBC) should be obtained for selected patients.[14,25]

Differential Diagnosis

Osteoarthritis

Osteoarthritis of the vertebral spine is common in later life, and is especially prevalent in the cervical and lumbar spine (also see Chapter 4). Typically, the pain of osteoarthritis of the spine is worse in the morning, increases with motion, but is relieved by rest. It is associated with morning stiffness, and a decreased range of motion of the spine in the absence of systemic symptoms. The severity of symptoms does not correlate well with radiographic findings, and patients with severe degenerative changes on plain radiographs may be asymptomatic, whereas patients with symptoms suggestive of osteoarthritis of the spine may have minimal radiologic findings. In some patients, extensive osteophytic changes may lead to compression of lumbar nerve roots or may even cause cauda equina syndrome.

Spinal Stenosis

Spinal stenosis is a common cause of back pain among older adults. Symptoms usually begin in the sixth decade, and over time the patient's posture becomes progressively flexed forward. The mean age of patients at the time of surgery for spinal stenosis is 55 years, with an average symptom duration of 4 years.[10] The symptoms of spinal stenosis are often diffuse because the disease is usually bilateral and involves several vertebrae. Pain, numbness, and tingling may occur in one or both legs. Pseudoclaudication is the classic symptom of spinal stenosis. Pseudoclaudication is differentiated from vascular claudication in that pseudoclaudication has a slower onset and a slower resolution of symptoms.[7]

Symptoms are usually relieved with flexion (e.g., sitting, pushing a grocery cart) and exacerbated by back extension. Plain radiographs often show osteophytes at several levels, but as mentioned earlier, caution must be used in ascribing back pain to these degenerative changes. CT or MRI may be used to confirm the diagnosis. Electromyography (EMG) or somatosensory evoked potentials may be used to differentiate the pain of spinal stenosis from peripheral neuropathy. The natural history of spinal stenosis is such that patients tend to remain stable or slowly worsen. Symptoms evolve gradually, but about 15% of patients improve over a period of about four years, 70% remain stable, and 15% experience worsening symptoms.[14] Nonoperative therapy for spinal stenosis includes leg strengthening and avoidance of alcohol to reduce the risk of falls, and physical activity such as walking or using an exercise bicycle is also recommended.[27] Decompressive laminectomy may be necessary for

selected patients with spinal stenosis who have persistent severe pain. Although treatment for spinal stenosis must be individualized, recent reports suggest that patients treated surgically have better outcomes at four years than patients treated nonsurgically, even after adjusting for differences in baseline characteristics.[28] However, at four-year follow-up, 30% of patients still have severe pain and 10% have undergone reoperation.[28]

Osteoporosis

Osteoporosis is a common problem among seniors, affecting up to 25% of women over 65. Decreased bone mineral density in the vertebral body is associated with an increased risk for spinal compression fractures. In primary care settings, 4% of patients who present with acute low back pain have compression fractures as the cause.[14] Pain symptoms are worse with prolonged sitting or standing, and usually resolve over three to four months as compression fractures heal.[6] African-American and Mexican-American women have only one fourth as many compression fractures as European-American women.[5] Patients with compression fractures due to osteoporosis usually have no neurological complaints and do not suffer from neural compression. Plain radiographs document a loss of vertebral body height due to compression fractures. Laboratory tests are normal in primary osteoporosis, and any abnormalities should prompt a search for secondary causes of osteoporosis. The diagnosis of primary osteoporosis is made on clinical grounds, i.e., diffuse osteopenia, compression fractures, and normal laboratory findings.[29,30]

Neoplasia

Multiple myeloma is the most common primary malignancy of the vertebral spine. However, metastatic lesions are the most common cause of cancers of the spine, arising from breast, lung, prostate, thyroid, renal, or gastrointestinal tract primary tumors. Both Hodgkin's and non-Hodgkin's lymphomas frequently involve the vertebral spine. Because the primary site of the tumor is often overlooked, back pain is the presenting complaint for many cancers. In primary care settings, 0.7% of patients who present with low back pain have cancer as the cause.[10,25] Findings significantly associated with cancer as the cause of low back pain include age >50 years, previous history of cancer, pain lasting >1 month, failure to improve with conservative therapy, elevated ESR, and anemia.[25] Patients report a dull constant pain that is worse at night, and not relieved by rest or the recumbent position. Typical radiographic changes may be absent early in the course of vertebral body tumors. A technetium bone scan is usually positive due

to increased blood flow and reactive bone formation; however, in multiple myeloma and metastatic thyroid cancer, the bone scan may be negative.[31] Greater diagnostic specificity and improved cost-effectiveness can be achieved by using a higher cut-off point for the ESR (e.g., >50 mm/hr) combined with either a bone scan followed by MRI as indicated, or MRI alone.[32] Symptomatic cancer of the lumbar spine is an ominous sign with a potential for devastating morbidity due to spinal cord injury.[33] Early recognition and treatment are essential if irreversible cord damage is to be avoided.

Posterior Facet Syndrome

The posterior facet syndrome is caused by degenerative changes in the posterior facet joints. These are true diarthrodial joints that sometimes develop degenerative joint changes visible on plain radiographs. Degenerative changes in the posterior facet joints cause a dull achy pain that radiates to the groin, hip, or thigh, and is worsened with twisting or hyperextension of the spine.[34] Steroid injection into the posterior facet joints to relieve presumed posterior facet joint pain is a popular procedure, but the placebo effect of injection in this area is significant and controlled studies have failed to demonstrate benefit from steroid injections.[35,36] The presence of degenerative changes in the facet joints on plain radiographs does not imply that the posterior facets are the cause of the patient's pain. Caution must be used in ascribing the patient's symptoms to these degenerative changes. Historically, the posterior facet syndrome was diagnosed by demonstrating pain relief after injection of local anesthetic into the posterior facet joints, but recent studies cast doubt on the validity of this procedure.[7,34] Several factors have been proposed to identify subjects who might benefit from lidocaine injection into lumbar facet joints: pain relieved in the supine position, age >65, and low back pain not worsened by coughing, hyperextension, forward flexion, rising from flexion, or extension-rotation.[37] However, a recent systematic review concluded that although facet joint injection provided some short-term relief, this benefit was not statistically significant; therefore, convincing evidence is lacking regarding the effects of facet joint injection therapy on low back pain.[38]

Ankylosing Spondylitis

Ankylosing spondylitis is a spondyloarthropathy most commonly affecting men under 40 years of age. Patients present with mild to moderate low back pain that is centered in the back and radiates to the posterior thighs. In its initial presentation, the symptoms are vague and the diagnosis is often overlooked. Pain symptoms are intermittent, but

decreased range of motion in the spine remains constant. Early signs of ankylosing spondylitis include limitation of chest expansion, tenderness of the sternum, and decreased range of motion and flexion contractures at the hip. Inflammatory involvement of the knees or hips increases the likelihood of spondylitis.[39] The radiological hallmarks of ankylosing spondylitis include periarticular destructive changes, obliteration of the sacroiliac joints, development of syndesmophytes on the margins of the vertebral bodies, and bridging of these osteophytes by bone between vertebral bodies, the so-called bamboo spine. Laboratory analysis is negative for rheumatoid factor, but the ESR is elevated early in the course of the disease. Tests for human leukocyte antigen (HLA)-B27 are not recommended because as many as 6% of an unselected population test positive for this antigen.[15]

Visceral Diseases

Several visceral diseases may present with back pain as a chief symptom.[5] These include nephrolithiasis, endometriosis, and abdominal aortic aneurysm. Abdominal aortic aneurysm causes low back pain by compression of surrounding tissues or by extension or rupture of the aneurysm. Patients report dull steady back pain unrelated to activity, which radiates to the hips or thighs. Patients with an acute rupture or extension of the aneurysm report severe tearing pain, diaphoresis, or syncope, and demonstrate signs of circulatory shock.[29]

Cauda Equina Syndrome

The cauda equina syndrome is a rare condition caused by severe compression of the cauda equina, usually by a large midline disc herniation or a tumor.[14] The patient may report urinary retention with overflow incontinence, as well as bilateral sciatica, leg weakness, and sensory loss in a saddle distribution. Patients with these findings represent a true surgical emergency, and should be referred immediately for surgical treatment and decompression.

Psychosocial Factors

Psychological factors are frequently associated with complaints of low back pain, influencing both patient pain symptoms and therapeutic outcome.[40] Features that suggest psychological causes of low back pain include nonorganic signs and symptoms, dissociation between verbal and nonverbal pain behaviors, compensable cause of injury, joblessness, disability-seeking, depression, anxiety, requests for narcotics or other psychoactive drugs, and repeated failure of multiple treatments.[41] Prolonged back pain may be associated with failure of previous treatment, depression, or somatization.[14] Substance abuse,

job dissatisfaction, pursuit of disability compensation and involvement in litigation are also associated with persistent unexplained symptoms.[8]

Management

Nonspecific Low Back Pain

For most patients, the best recommendation is rapid return to normal daily activities. However, patients should avoid heavy lifting, twisting, or bodily vibration in the acute phase.[14] A four- to six-week trial of conservative therapy is appropriate in the absence of cauda equina syndrome or a rapidly progressive neurological deficit (Table 1.2).

Bed Rest

Bed rest does not increase the speed of recovery from acute back pain, and sometimes delays recovery.[42,43] Symptomatic relief from back pain may benefit from one or two days of bed rest, but patients should be told that it is safe to get out of bed even if pain persists.[14]

Medications

Anti-inflammatories. Nonsteroidal anti-inflammatory drugs (NSAIDs) are effective for short-term symptomatic relief in patients with acute low back pain.[44] There does not seem to be a specific type of NSAID that is clearly more effective than others.[44] Therapy is titrated to provide pain relief at a minimal dose, and is continued for four to six weeks. NSAIDs should not be continued indefinitely, but rather prescribed for a specific period.[3]

Muscle Relaxants. Although evidence for the effectiveness of muscle relaxants is scant, the main value of muscle relaxants is less for muscle relaxation than for their sedative effect. Diazepam (Valium), cyclobenzaprine (Flexeril), and methocarbamol (Robaxin) are commonly used as muscle relaxants, and carisoprodol (Soma) has documented effectiveness.[3] Muscle relaxants should be prescribed in a time-limited fashion, usually less than two weeks. Muscle relaxants and narcotics are not recommended for patients who present with complaints of chronic low back pain (i.e., low back pain of greater than three months' duration).[5]

Unproven Treatments

Traction is not recommended for the treatment of acute low back pain.[45] No scientific evidence supports the efficacy of corsets or braces in the treatment of acute low back pain, and these treatments

Table 1.2. **Nonoperative Treatment Considerations for Low Back Pain and Sciatica**

Treatment	Acute low back pain	Acute sciatica	Subacute low back pain and leg pain	Chronic low back pain and leg pain
Bedrest	Avoid	Avoid	Avoid	Avoid, short-term for flare-ups only
NSAIDs	Symptomatic pain relief, time-limited	Symptomatic pain relief, time-limited	Selected cases if effective	Avoid long-term
Muscle relaxants	Optimal 1 week; maximum 2–4 weeks	Optimal 1 week; maximum 2–4 weeks	Selected cases if effective	Avoid long-term
Opioids	No	Optimal 1–3 days; maximum 2–3 weeks	Selected pre-surgical cases; avoid	Avoid
Antidepressants	No	No	Selected cases	Yes
Local injections	No	No	Selected cases as an adjunct	Flare-ups
Facet injections	No	No	No	Avoid; no long-term effect alone
Epidural corticosteroids	No	Yes	Flare-ups, if effective	Flare-ups only; avoid
Orthoses	Adjunctive	No	Adjunctive	Adjunctive
Cryotherapy (ice)	Adjunctive	Adjunctive	Flare-ups	Flare-ups; self-applied
Thermotherapy	Adjunctive	Adjunctive	Adjunctive	Flare-ups; self-applied

Traction	No	No	No	No
Joint manipulation	Not recommended for first 3–4 weeks	Not with neural signs	If effective; maximum 2–4 months	Flare-ups; time-contingent if effective
Joint mobilization	Yes, if effective	Yes, if effective	If effective; maximum 2–4 months	Flare-ups; time-contingent if effective
Soft tissue techniques (massage, myofascial release, mobilization)	Yes, if effective	Yes, if effective	If effective; maximum 2–4 months	Flare-ups; time-contingent if effective
McKenzie exercises	No	No	Flare-ups, if effective	Flare-ups, if effective
Dynamic lumbar stabilization	No	No	Yes	Yes
Back school	Yes	Yes	Yes	Yes
Functional restoration	No	No	Yes	Optimal 3–4 months; maximum 4–6 months
Pain clinic	No	No	No	Yes

NSAID = nonsteroidal antiinflammatory drug.
Source: Adapted from Wheeler,[41] with permission.

are not recommended.[5] Transcutaneous electrical nerve stimulation (TENS) is not effective in the treatment of low back pain.[46]

Exercise

Back exercises are not useful in the acute phase of low back pain, but are useful later for preventing recurrences.[14] Guidelines from the Agency for Health Care Policy and Research (AHCPR) stress aerobic exercise (e.g., walking, biking, swimming) especially during the first two weeks; continuing ordinary activities improves recovery and leads to less disability.[22] However, a recent systematic review concluded that specific back exercises do not improve clinical outcomes.[47] There is moderate evidence that flexion exercises are not effective in the treatment of acute low back pain, and strong evidence that extension exercises are not effective in the treatment of acute low back pain.

Spinal Manipulation

Clinical trials suggest that spinal manipulation has some efficacy.[48,49] Current recommendations are that patients should not be referred for spinal manipulation unless pain persists for more than three weeks because half of patients spontaneously improve during this time frame.[14]

Back School

A recent systematic review concluded that there is moderate evidence that back schools are not more effective than other treatments for acute low back pain.[50]

Acupuncture

A recent systematic qualitative review concluded that there is no evidence to show that acupuncture is more effective than no treatment, moderate evidence to show that acupuncture is not more effective than trigger point injection or TENS, and limited evidence to show that acupuncture is not more effective than placebo or sham procedure for the treatment of chronic low back pain.[51] Therefore, acupuncture is not recommended as a regular treatment for patients with low back pain.

Herniated Intervertebral Disc

Early treatment resembles that for nonspecific low back pain, outlined above. However, for patients with suspected lumbar disc herniation, the role of spinal manipulation is not clear. Narcotic analgesics may

be necessary for pain relief for some patients with herniated intervertebral disc, but these medications should be used in a time-limited (i.e., not symptom-limited) manner.[14] Epidural corticosteroid injection may offer temporary symptomatic relief for some patients.[52] However, this invasive procedure offers no significant functional improvement, and does not reduce the need for surgery.[52] If neuropathic pain persists and/or neurological deficits progress, CT or MRI should be performed, and surgery should be considered.[14]

Surgery

Background. The rate of lumbar surgery in the United States is 40% higher than in most developed nations, and five times higher than in England and Scotland.[53] The lifetime prevalence of lumbar spine surgery ranges between 1% and 3%, and 2% to 3% of patients with low back pain may be surgical candidates on the basis of sciatica alone.[12] Surgery rates vary widely by geographical region in the United States and have risen dramatically in the last ten years.[54] Psychological factors influence postsurgical outcomes more strongly than initial physical examination or surgical findings. Prior to surgery, patients should be evaluated with standard pain indices, activities of daily living scales, and psychometric testing. Surgical results for treating symptomatic lumbar disc herniation unresponsive to conservative therapy are excellent in well-selected patients.[55]

Indications. There is no evidence from clinical trials or cohort studies that surgery is effective for patients who have low back pain unless they have sciatica, pseudoclaudication, or spondylolisthesis.[56] In the absence of cauda equina syndrome or progressive neurological deficit, patients with suspected lumbar disc herniation should be treated nonsurgically for at least a month.[14] The primary benefit of discectomy is to provide more rapid relief of sciatica in patients who have failed to resolve with conservative management.[56] In well-selected patients, 75% have complete relief of sciatic symptoms after surgery and an additional 15% have partial relief. Patients with clear symptoms of radicular pain have the best surgical outcome, whereas those with the least evidence of radiculopathy have the poorest surgical outcome.[57] Relief of back pain itself is less consistent. Appropriate patient selection is key to successful surgical outcome.

Options. Standard discectomy is the most common procedure used to relieve symptomatic disc herniation. A posterior longitudinal incision is made over the involved disc space, a variable amount of bone

is removed, the ligamentum flavum is incised, and herniated disc material is excised. This procedure allows adequate visualization and yields satisfactory results among 65% to 85% of patients.[11,58] Recent reports suggest that patients who undergo surgical therapy have greater improvement of their symptoms and greater functional recovery at four years than patients treated nonoperatively;[59] however, work status and disability status were similar between these two groups. Previous studies have shown that there is no clear benefit to surgery at ten-year follow-up.[11]

Microdiscectomy allows smaller incisions, little or no bony excision, and removal of disc material under magnification. This procedure has fewer complications, fewer unsuccessful outcomes, and permits faster recovery. However, rates of reoperation are significantly higher in patients initially treated with microdiscectomy, presumably due to missed disc fragments or operating at the wrong spinal level.[58] A recent systematic review concluded that the clinical outcomes for patients after microdiscectomy are comparable to those of standard discectomy.[56]

Percutaneous discectomy is an outpatient procedure performed under local anesthesia in which the surgeon uses an automated percutaneous cutting and suction probe to aspirate herniated disc material. This procedure results in lower rates of nerve injury, postoperative instability, infection, fibrosis, and chronic pain syndromes. However, patients undergoing percutaneous discectomy sustain unacceptably high rates of recurrent disc herniation. Only 29% of patients reported satisfactory results after percutaneous discectomy, whereas 80% of subjects were satisfied after microdiscectomy.[60] A recent systematic review concluded that only 10% to 15% of patients with herniated nucleus pulposus requiring surgery might be suitable candidates for percutaneous discectomy.[56] This procedure is not recommended for patients with previous back surgery, sequestered disc fragments, bony entrapment, or multiple herniated discs.[58,61]

For the time being, automated percutaneous discectomy and laser discectomy should be regarded as research techniques.[56] Arthroscopic discectomy is an emerging technique that shows promising results and effectiveness similar to that of standard discectomy.[62]

Chemonucleolysis is a procedure in which a proteolytic enzyme (chymopapain) is injected into the disc space to dissolve herniated disc material. A recent systematic review concluded that chemonucleolysis is effective for the treatment of patients with low back pain due to herniated nucleus pulposus, and is more effective than placebo.[56] However, chemonucleolysis showed consistently poorer results than

standard discectomy. Approximately 30% of patients undergoing chemonucleolysis had further disc surgery within two years. Proponents of chemonucleolysis have suggested that it may be associated with lower costs, but readmission for a second procedure negates this putative advantage. Chemonucleolysis may be indicated for selected patients as an intermediate stage between conservative and surgical management.[56]

Complications. Complications of surgery on the lumbar spine are largely related to patient age, gender, diagnosis, and type of procedure.[63] Mortality rates increase substantially with age, but are $<1\%$ even among patients over 75 years of age. Mortality rates are higher for men, but morbidity rates and likelihood of discharge to a nursing home are significantly higher for women, particularly women over 75. With regard to underlying diagnosis, complications and duration of hospitalization are highest after surgery to correct spinal stenosis, degenerative changes, or instability, and are lowest for procedures to correct herniated disc. With regard to type of procedure, complications and duration of hospitalization are highest for procedures involving arthrodesis with or without laminectomy, followed by laminectomy alone or with discectomy, and are lowest for discectomy alone. Other surgical complications include thromboembolism (1.7%) and infection (2.9%).[5]

Summary

The physician's goal in treating patients with low back pain is to promote activity and early return to work. Although it is important to rule out significant pathology as the cause of low back pain, most patients can be reassured that symptoms are due to simple musculoligamentous injury.[14] Patients should be counseled that they will improve with time, usually quite quickly.

Bed rest is not recommended for the treatment of low back pain or sciatica; rather, a rapid return to normal activities is usually the best course.[14] Nonsteroidal anti-inflammatory drugs can be used in a time-limited way for symptomatic relief.[44] Back exercises are not useful for acute low back pain, but can help prevent recurrence of back pain and can be used to treat patients with chronic low back pain.[14] Work activities may be modified at first, but avoiding iatrogenic disability is key to successful management of acute low back pain.[5,41] Surgery should be reserved for patients with progressive neurological deficit or those who have sciatica or pseudoclaudication that persists after nonoperative therapy has failed.[14]

Chronic Low Back Pain

Chronic low back pain (i.e., pain persisting for more than three months) is a special problem that warrants careful consideration. Patients presenting with a history of chronic low back pain require an extensive diagnostic workup on at least one occasion, including in-depth history, physical examination, and the appropriate imaging techniques (plain radiographs, CT, or MRI).

Management of patients with chronic back pain should be aimed at restoring normal function.[47] Exercises may be useful in the treatment of chronic low back pain if they aim at improving return to normal daily activities and work.[47] A recent systematic review concluded that exercise therapy is as effective as physiotherapy (e.g., hot packs, massage, mobilization, short-wave diathermy, ultrasound, stretching, flexibility, electrotherapy) for patients with chronic low back pain.[47] And there is strong evidence that exercise is more effective than "usual care." Evidence is lacking about the effectiveness of flexion and extension exercises for patients with chronic low back pain.[47]

Although one literature synthesis cast doubt on the effectiveness of antidepressant therapy for chronic low back pain,[64] it is widely used and recommended.[14] Antidepressant therapy is useful for the one third of patients with chronic low back pain who also have depression. Tricyclic antidepressants may be more effective for treating pain in patients without depression than selective serotonin reuptake inhibitors.[65] However, narcotic analgesics are not recommended for patients with chronic low back pain.[14]

A recent systematic review concluded that there is moderate evidence that back schools have better short-term effects than other treatments for chronic low back pain, and moderate evidence that back schools in an occupational setting are more effective compared to placebo or "waiting list" controls.[50] Functional restoration programs combine intense physical therapy with cognitive-behavioral interventions and increasing levels of task-oriented rehabilitation and work simulation.[41] Patients with chronic low back pain may require referral to a multidisciplinary pain clinic for optimal management. Such clinics can offer cognitive-behavioral therapy, patient education classes, supervised exercise programs, and selective nerve blocks to facilitate return to normal function.[14] Complete relief of symptoms may be an unrealistic goal; instead, patients and physicians should try to optimize daily functioning.

Prevention

Prevention of low back injury and consequent disability is an important challenge in primary care. Pre-employment physical examination

screening is not effective in reducing the occurrence of job-related low back pain. However, active aerobically fit individuals have fewer back injuries, miss fewer workdays, and report fewer back pain symptoms.[66] Evidence to support smoking cessation and weight loss as means of reducing the occurrence of low back pain is sparse, but these should be recommended for other health reasons.[66] Exercise programs that combine aerobic conditioning with specific strengthening of the back and legs can reduce the frequency of recurrence of low back pain.[44,66] The use of corsets and education about lifting technique are generally ineffective in preventing low back problems.[67,68] Ergonomic redesign of strenuous tasks may facilitate return to work and reduce chronic pain.[69]

Disorders of the Neck

Cervical Radiculopathy

Cervical radiculopathy is a common cause of neck pain, and can be caused by a herniated cervical disc, osteophytic changes, compressive pathology, or hypermobility of the cervical spine. The lifetime prevalence of neck and arm pain among adults may be as high as 51%. Risk factors associated with neck pain include heavy lifting, smoking, diving, working with vibrating heavy equipment, and possibly riding in cars.[70]

Cervical nerve roots exit the spine above the corresponding vertebral body (e.g., the C5 nerve root exits above C5). Therefore, disc herniation at the C4–C5 interspace causes symptoms in the distribution of C5.[71] Radicular symptoms may be caused by a "soft disc" (i.e., disc herniation) or by a "hard disc" (i.e., osteophyte formation and foraminal encroachment).[71] The most commonly involved interspaces are C5–6, C6–7, C4–5, C3–4, and C7–T1.[70]

The symptoms of cervical radiculopathy may be single or multiple, unilateral or bilateral, symmetrical or asymmetrical.[72] Acute cervical radiculopathy is commonly due to a tear of the annulus fibrosus with prolapse of the nucleus pulposus, and is usually the result of mild to moderate trauma. Subacute symptoms are usually due to long-standing spondylosis accompanied by mild trauma or overuse. The majority of patients with subacute cervical radiculopathy experience resolution of their symptoms within six weeks with rest and analgesics. Chronic radiculopathy is more common in middle age or old age, and patients present with complaints of neck or arm pain due to heavy labor or unaccustomed activity.[72–74]

Cervical radiculopathy rarely progresses to myelopathy, but as many as two thirds of patients treated conservatively report persistent symptoms. In severe cases of cervical radiculopathy in which motor

function has been compromised, 98% of patients recover full motor function after decompressive laminectomy.[75]

Clinical Presentation

Among patients with cervical radiculopathy, sensory symptoms are much more prominent than motor changes. Typically, patients report proximal pain and distal paresthesias.[71] The fifth, sixth, and seventh nerve roots are most commonly affected. Referred pain caused by cervical disc herniation is usually vague, diffuse, and lacking in the sharp quality of radicular pain. Pain referred from a herniated cervical disc may present as pain in the neck, pain at the top of the shoulder, or pain around the scapula.[72]

On physical examination, radicular pain increases with certain maneuvers such as neck range of motion, Valsalva maneuver, cough, or sneeze. Active and passive neck range of motion is tested, examining flexion, rotation, and lateral bending. Spurling's maneuver is useful in assessing neck pain: the examining physician flexes the patient's neck, then rolls the neck into lateral bending, and finally extends the neck. The examiner then applies a compressive load to the vertex of the skull. This maneuver narrows the cervical foramina posterolaterally, and may reproduce the patient's radicular symptoms.

Diagnosis

The differential diagnosis of cervical nerve root pain includes cervical disc herniation, spinal canal tumor, trauma, degenerative changes, inflammatory disorders, congenital abnormalities, toxic and allergic conditions, hemorrhage, and musculoskeletal syndromes (e.g., thoracic outlet syndrome, shoulder pain).[71,75] In cases of cervical radiculopathy unresponsive to conservative therapy, or in the presence of progressive motor deficit, investigation of other pathologic processes is indicated. Plain radiographs are usually not helpful because abnormal radiographic findings are equally common among symptomatic and asymptomatic patients. CT scan, myelography, and MRI each have a specific role to play in the diagnosis of cervical radiculopathy.[73,74] CT scan is especially useful in delineating bony lesions, CT myelography can effectively demonstrate functional stenoses of the spinal canal, and MRI is an excellent noninvasive modality for demonstrating soft tissue abnormalities (e.g., herniated cervical disc, spinal cord derangement, extradural tumor).

Management

Immobilization. The purpose of neck immobilization is to reduce intervertebral motion which may cause compression, mechanical

irritation, or stretching of the cervical nerve roots.[76] The soft cervical collar or the more rigid Philadelphia collar both hold the neck in slight flexion. The collar is useful in the acute setting, but prolonged use leads to deconditioning of the paracervical musculature. Therefore, the collar should be prescribed in a time-limited manner, and patients should be instructed to begin isometric neck exercises early in the course of therapy.

Bed Rest. Bed rest is another form of immobilization that modifies the patient's activities and eliminates the axial compression forces of gravity.[76] Holding the neck in slight flexion is accomplished by arranging two standard pillows in a V shape with the apex pointed cranially, then placing a third pillow across the apex. This arrangement provides mild cervical flexion, and internally rotates the shoulder girdle, thereby relieving traction on the cervical nerve roots.

Medications. Nonsteroidal anti-inflammatory drugs (NSAIDs) are particularly beneficial in relieving acute neck pain. However, side effects are common, and usually two or three medications must be tried before a beneficial result without unacceptable side effects is achieved. Muscle relaxants help relieve muscle spasm in some patients; alternatives include carisoprodol (Soma), methocarbamol (Robaxin), and diazepam (Valium). Narcotics may be useful in the acute setting, but should be prescribed in a strictly time-limited manner.[76] The physician should be alert to the possibility of addiction or abuse.

Physical Therapy. Moist heat (20 minutes, three times daily), ice packs (15 minutes, four times daily or even hourly), ultrasound therapy, and other modalities also help relieve the symptoms of cervical radiculopathy.[76]

Surgery. Surgical intervention is reserved for patients with cervical disc herniation confirmed by neuroradiologic imaging and radicular signs and symptoms that persist despite four to six weeks of conservative therapy.[71]

Cervical Myelopathy

The cause of pain in cervical myelopathy is not clearly understood but is presumed to be multifactorial, including vascular changes, cord hypoxia, changes in spinal canal diameter, and hypertrophic facets. Therefore, patients with cervical myelopathy present with a variable

clinical picture. The usual course is one of increasing disability over several months, usually beginning with dysesthesias in the hands, followed by weakness or clumsiness in the hands, and eventually progressing to weakness in the lower extremities.[72]

Clinical Presentation

In cases of cervical myelopathy secondary to cervical spondylosis, symptoms are usually insidious in onset, often with short periods of worsening followed by long periods of relative stability.[77] Acute onset of symptoms or rapid deterioration may suggest a vascular etiology.[71] Unlike cervical radiculopathy, cervical myelopathy rarely presents with neck pain; instead, patients report an occipital headache that radiates anteriorly to the frontal area, is worse on waking, but improves through the day.[72] Patients also report deep aching pain and burning sensations in the hands, loss of hand dexterity, and vertebrobasilar insufficiency, presumably due to osteophytic changes in the cervical spine.[71,72]

On physical examination, patients demonstrate motor weakness and muscle wasting, particularly of the interosseous muscles of the hand. Lhermitte's sign is present in approximately 25% of patients, i.e., rapid flexion or extension of the neck causes a shocklike sensation in the trunk or limbs.[71] Deep tendon reflexes are variable. Involvement of the anterior horn cell causes hyporeflexia, whereas involvement of the corticospinal tracts causes hyperreflexia. The triceps jerk is the reflex most commonly lost, due to frequent involvement of the sixth nerve root (i.e., the C5–6 interspace). Almost all patients with cervical myelopathy show signs of muscular spasticity.

Diagnosis

Radiologic Diagnosis in Cervical Spondylosis. Intrathecal contrast-enhanced CT scan is a highly specific test that allows evaluation of the intradural contents and the disc margins, and helps differentiate an extradural defect due to disc herniation from that due to osteophytic changes.[73] MRI allows visualization of the cervical spine in both the sagittal and axial planes. Resolution with MRI is sharp enough to identify lesions of the spinal cord and differentiate disc herniation from spinal stenosis.[73] CT scan is preferred in evaluating osteophytes, foraminal encroachment, and other bony changes. CT and MRI complement each other, and their use should be individualized for each patient.[74] Clinical correlation of abnormal neuroradiologic findings is essential because degenerative changes of the cervical spine and cervical disc are common even among asymptomatic patients.[73,74]

Management

Conservative Therapy. Most patients with cervical myelopathy present with minor symptoms and demonstrate long periods of nonprogressive disability. Therefore, these patients should initially be treated conservatively: rest with a soft cervical collar, physical therapy to promote range of motion, and judicious use of NSAIDs. However, only 30% to 50% of patients improve with conservative management. A recent multicenter study comparing the efficacy of surgery versus conservative management demonstrated broadly similar outcomes with regard to activities of daily living, symptom index, function, and patient satisfaction.[77]

Surgery. Early surgical decompression is appropriate for patients with cervical myelopathy who present with moderate or severe disability, or in the presence of rapid neurological deterioration.[78] Anterior decompression with fusion, posterior decompression, laminectomy, or laminoplasty is appropriate to particular clinical situations.[79] The best surgical prognosis is achieved by careful patient selection. Accurate diagnosis is essential, and patients with symptoms of relatively short duration have the best prognosis.[71] If surgery is considered, it should be performed early in the course of the disease, before cord damage becomes irreversible.

Surgical decompression is recommended for patients with severe or progressive symptoms; excellent or good outcomes can be expected for approximately 70% of these patients.[77]

Cervical Whiplash

Cervical whiplash is a valid clinical syndrome, with symptoms consistent with anatomic sites of injury, and a potential for significant impairment.[80] Whiplash injuries afflict more than 1 million people in the U.S. each year,[81] with an annual incidence of approximately 4 per 1000 population.[82] Symptoms in cervical whiplash injuries are due to soft tissue trauma, particularly musculoligamentous sprains and strains to the cervical spine. After a rear-end impact in a motor vehicle accident, the patient is accelerated forward and the lower cervical vertebrae are hyperextended, especially at the C5–6 interspace. This is followed by flexion of the upper cervical vertebrae, which is limited by the chin striking the chest. Hyperextension commonly causes an injury to the anterior longitudinal ligament of the cervical spine and other soft tissue injuries of the anterior neck including muscle tears, muscle hemorrhage, esophageal hemorrhage, or disc disruption. Muscles most commonly injured include the sternocleidomastoid, scalenus, and longus colli muscles.

Neck pain and headache are the cardinal features of whiplash injury.[83] Injury to the upper cervical segments may cause pain referred to the neck or the head and presents as neck pain or headache. Injury to the lower cervical segments may cause pain referred to shoulder and or arm. Patients may also develop visual disturbances, possibly due to vertebral, basilar, or other vascular injury, or injury to the cervical sympathetic chain.[81]

After acute injury most patients recover rapidly: 80% are asymptomatic by 12 months, 15% to 20% remain symptomatic after 12 months, and only 5% are severely affected.[83] However this last group of patients generates the greatest healthcare costs.

Clinical Presentation

On history, patients describe a typical rear-end impact motor vehicle accident with hyperextension of the neck followed by hyperflexion. Pain in the neck may be immediate or may be delayed hours or even days after the accident. Pain is usually felt at the base of the neck and increases over time. Patients report pain and decreased range of motion in the neck, which is worsened by motion or activity, as well as paresthesias or weakness in the upper extremities, dysphagia, or hoarseness.

Physical examination may be negative if the patient is seen within hours of the accident. Over time, however, patients develop tenderness in the cervical spine area, as well as decreased range of motion and muscle spasm. Neurological examination of the upper extremity should include assessment of motor function and grip strength, sensation, deep tendon reflexes, and range of motion (especially of the neck and shoulder).

Diagnosis

Findings on plain radiographs are usually minimal. Five views of the cervical spine should be obtained: anteroposterior, lateral, right and left obliques, and the odontoid view. Straightening of the cervical spine or loss of the normal cervical lordosis may be due to positioning in radiology, muscle spasm, or derangement of the skeletal alignment of the cervical spine. Radiographs should also be examined for soft tissue swelling anterior to the C3 vertebral body, which may indicate an occult fracture. Signs of pre-existing degenerative changes such as osteophytic changes, disc space narrowing, or narrowing of the cervical foramina are also common. Electromyography and nerve conduction velocity tests should be considered if paresthesias or radicular pain are present. Technetium bone scan is very sensitive in

detecting occult injuries. However, whiplash injuries usually cause soft tissue injuries that are not demonstrable with most of these studies. For example, MRI of the brain and neck of patients within two days of whiplash injury shows no difference between subjects and controls.[84] Therefore, CT or MRI should be reserved for patients with neurological deficit, intense pain within minutes of injury, suspected spinal cord or disc damage, suspected fracture, or ligamentous injury.[81,82]

Management

Many patients recover within six months without any treatment. However, treatment may speed the recovery process and limit the amount of pain the patient experiences during recovery.[82]

Rest. Although rest in a soft cervical collar has been the traditional treatment for patients with whiplash injury, recent studies indicate that prolonged rest (i.e., two weeks or more) and/or excessive use of the soft cervical collar may be detrimental and actually slow the healing process.[85] Initially, patients should be treated with a brief period of rest and protection of the cervical spine, usually with a soft cervical collar for three or four days. The collar holds the neck in slight flexion; therefore, the widest part of the cervical collar should be worn posteriorly. The cervical collar is especially useful in alleviating pain if worn at night or when driving. If used during the day, it should be worn one or two hours and then removed for a similar period in order to preserve paracervical muscle conditioning. The soft cervical collar should not be used for more than a few days; early in the course of treatment, the patient should be encouraged to begin mobilization exercises for the neck.[81]

Medications. NSAIDs are effective in treating the pain and muscle spasm caused by whiplash injuries. Muscle relaxants are a useful adjunct, especially when used nightly, and should be prescribed in a time-limited manner. Narcotics are usually not indicated in the treatment of whiplash injuries.

Physical Therapy. A treatment protocol with proven success involves early active range of motion and strengthening exercises.[86] Patients are instructed to perform gentle rotational exercises ten times an hour as soon as symptoms allow within 96 hours of injury. Patients who comply with early active treatment protocols report significantly reduced pain and a significantly improved range of motion.

Physical modalities alleviate symptoms of pain and muscle spasm. Early in the course of whiplash injuries, heat modalities for 20 to 25 minutes, every three to four hours, are useful. However, excessive use of heat modalities can actually delay recovery. Later in the course of whiplash injury, usually two to three days after injury, cold therapy is indicated to decrease muscle spasm and pain. Range of motion exercises followed by isometric strengthening exercises should be initiated early in the therapy of whiplash injuries, even immediately after injury. Patients should be given specific instructions regarding neck exercises and daily activities. Patient education programs regarding exercises, daily activities, body mechanics, and the use of heat and cold modalities, are also helpful. The patient should be encouraged to remain functional in spite of pain or other symptoms. Any increase in pain following exercise should not be seen as a worsening of the injury. Prolonged physiotherapy should be avoided, because it reinforces the sick role for the patient.[81]

Multimodal treatments maximize success rates after cervical whiplash injury.[82] The goals of therapy are to restore normal function and promote early return to work. Physical therapy is used to reduce inappropriate pain behaviors, strengthen neck musculature, and wean patients off use of a soft cervical collar. Occupational therapy is used to facilitate the patient's return to normal functioning in the workplace. Neuropsychological counseling may be helpful for some patients.

Intra-Articular Corticosteroid Injection. Intra-articular injection of corticosteroids is not effective therapy for pain in the cervical spine following whiplash injury.[87]

Prognosis

Most patients with whiplash injuries have negative diagnostic studies but improve, although slowly and irregularly. Patients benefit from a program of rest, immobilization, neck exercises, and return to function. At two-year follow-up, approximately 82% of patients with whiplash injury can expect to be symptom-free. Patients with persistent symptoms are older, have more signs of spondylosis on cervical radiographs, and probably sustained more severe initial injuries. Patients symptomatic at two-year follow-up initially reported more pain, a greater variety of pain symptoms, had higher rates of pretraumatic headache, and had more rapid onset of postinjury symptoms. Symptomatic and asymptomatic patients were similar with regard to

gender, vocation, and psychological variables.[88] Some patients who sustain a whiplash injury never recover completely, probably due to a combination of the severity of the injury, underlying cervical abnormalities, and psychosocial factors.[81]

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